HANDY GUIDE

FOR

Filers, Sawyers and Millmen

BY

COVEL MANUFACTURING CO.
CHICAGO, ILL., U. S. A.

THIRD EDITION

WITH GENERAL INSTRUCTIONS FOR HAMMERING SAWS
THEIR CARE AND USAGE

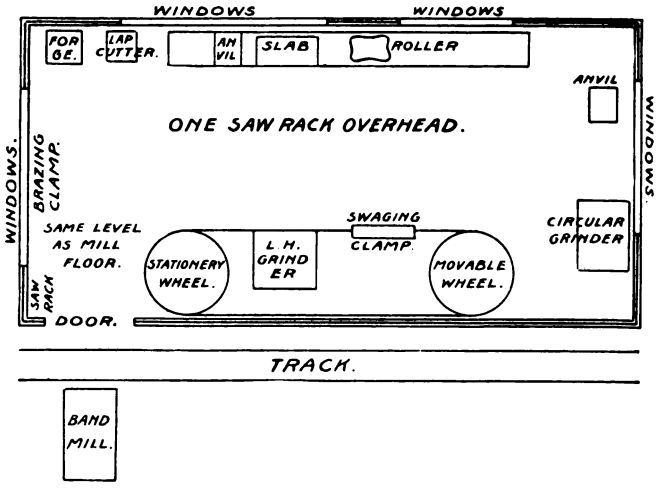
INTRODUCTION

The Band Saw has proven a great success in the manufacture of all kinds of lumber. There was a time when it was admitted the use of a band saw meant a great saving in timber, but it was claimed they were more expensive to operate, and did not have as great a capacity as that of the circular saw, but it is now generally conceded by all who are thoroughly familiar with the use of both saws that the band is superior to the circular, both in quality and quantity of lumber cut, and that the cost of operating does not exceed that of a first-class circular mill. However this may be, we will all agree that the band saw is here to stay, and whatever tends to perfect and increase their usefulness, and to lessen the cost of labor in taking care of and running them, will be of great value, both to the millmen and

to the filer who is entrusted to keep the saws and mill in good running order. The greatest difficulty which confronts all who were possessed with a desire of obtaining knowledge on this subject is the fact that there was no means by which they could secure proper instructions, and to acquire the knowledge through actual experience, not only meant years of hard labor and careful study, but was a source of great expense and injustice to their employers. The object of this work is to so clearly illustrate and describe the handling and care of band saws, treating every detail of the work in such a careful, simple and thorough manner, that any one possessed of ordinary intelligence and a mechanical turn of mind, who will carefully study the following pages, may become an expert on the care of saws, even though he has had no former experience. What we have to offer is not the experience of any one man, nor is any part of it based on any one's theories or ideas which

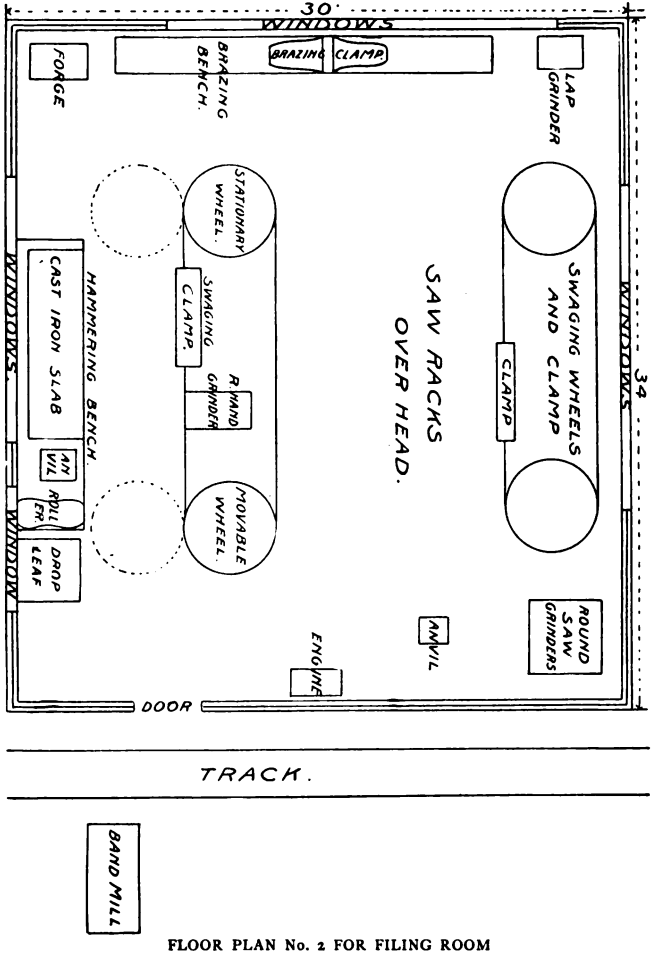
have not been carefully tested and found to contain all the merits claimed for them. We have united with our own experience that of a majority of the most able and successful filers throughout the United States and Canada. To secure this information it has required a vast outlay of money and years of extensive travel, canvassing from mill to mill, talking with the filers, examining their saws, and the work they were doing and making a careful note of anything found which was new and might be beneficial to the trade, until now we possess a knowledge which is obtained by but very few, and we take pride in being able to place before the public, and before millmen and filers in particular, information which will prove strictly reliable. In the following instructions we will illustrate and describe only such methods of work as we consider the best, more practical, and simple. For to describe the various methods by which prac-

tically the same results may be obtained and then offer objections to some and state the merits found in others, would make a work far too extensive and confusing for the average workman, who is searching after the best and most simple way in which the work can be performed, so it may be taken for granted that anything not found in this work has not our approval, and is, therefore, not mentioned.

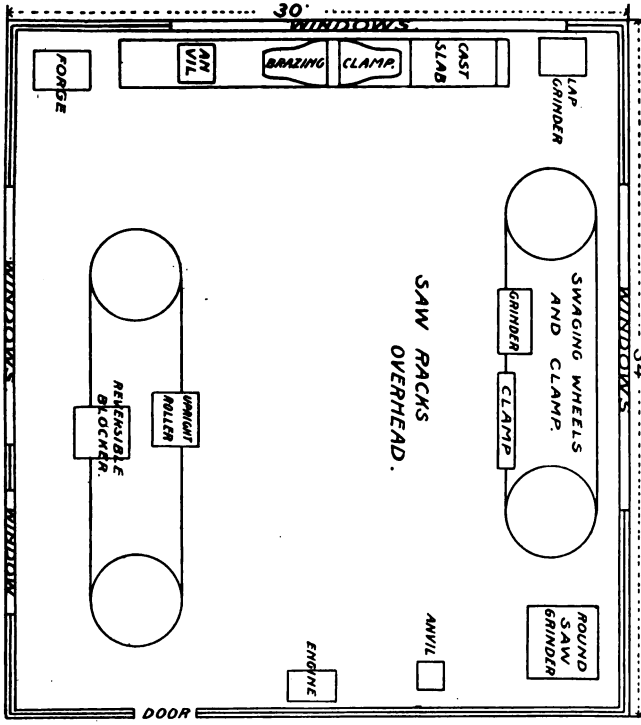


FLOOR PLAN No. 1 FOR FILING ROOM

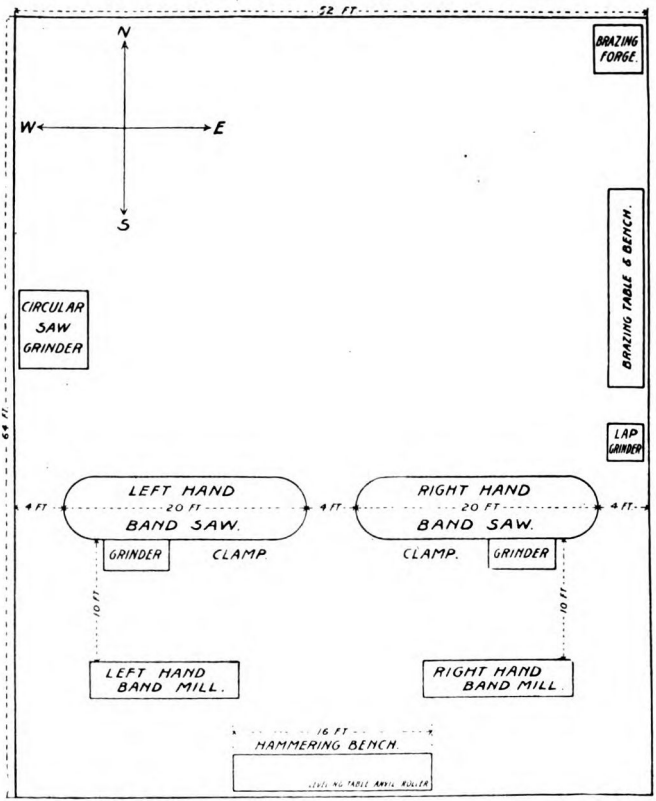
We submit herewith different plans, prepared by competent filers, showing how sharpeners and all necessary tools to be used in a filing room could be placed to the best advantage, particular care being given to the saving of labor, and obtaining the best results as to light and other conveniences.



FLOOR PLAN No. 2 FOR FILING ROOM



FLOOR PLAN No. 3 FOR FILING ROOM



FLOOR PLAN No. 4 FOR FILING ROOM

THE BAND SAW FILING ROOM.

On pages 7, 8, 9 and 10 you will find a convenient arrangement for the machines in this room, and we will say that the room should be well lighted from the sides. A sky-light may be very good for dressing the saw teeth, but it is a very poor light for hammering, rolling, tensioning or leveling a saw. For this work you should have a good strong light from the sides of the building, and the windows should be provided with dark shades and spring rollers, so that the operator will be able to conveniently shade or reflect the light to any part of the room his work may require. When you come to understand that while examining a saw for defects, the operator is guided wholly by the light which shows between the straight edge or tension gauge and the saw blade to which it is held, you will also understand the necessity of having a dark background and a strong light in front and to effect this condition the shades are brought into use. They can be drawn down while working at the bench and raised to give abundant light while dressing the teeth or doing other work which may require strong light on both sides.

WHAT IS REQUIRED IN A FILING ROOM.

The filing room should be provided with a bench conveniently arranged and equipped for handling, straightening, tensioning and leveling the saw. It should also be provided with an automatic Sharpener, Roller, Lap Grinder, Brazing Outfit, Swage, Side Dresser, Straight Edges, Tension Gauges, Hammers and other tools, all of which is fully described with instructions for their use, and suggestions for their proper construction and arrangement, in the following pages.

THE HAMMERING BENCH.

On page 13, Fig. 1, you will find illustrated a very convenient form of bench. "A" is the bench proper, and should be made of wood and arranged to receive and hold the tools shown in cut, and described on the following pages. "B" is a machine for rolling, tensioning and straightening the back of saws. "C" is an iron block on which to level the saw after it has the proper tension, and the back has been brought to a true line, either straight or curved, whichever the filer may prefer. "D" is an anvil which should have a hard face, on

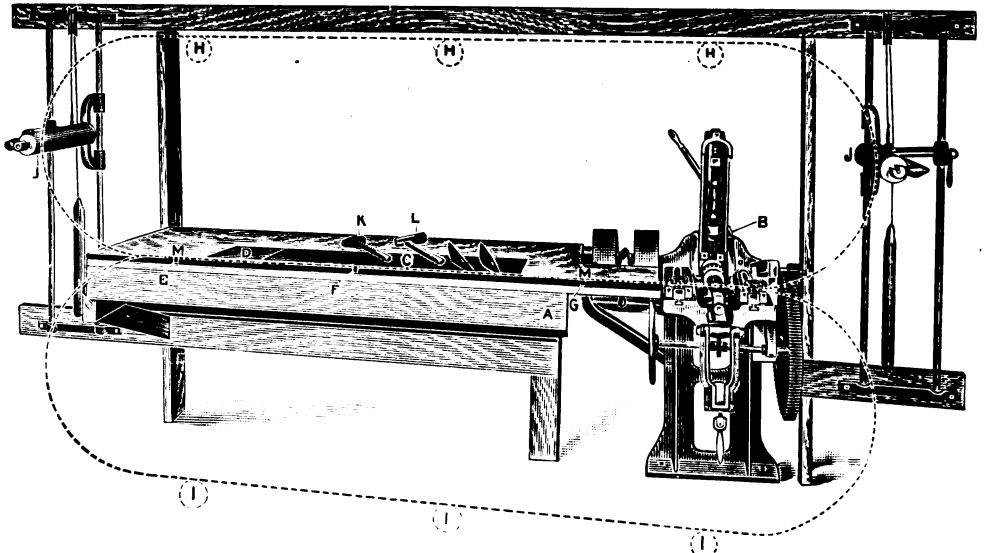


FIG. 1

which to do the heavy work that the leveling block would not stand without injury. "E," "F," "G" are iron pins set parallel with the bench, and are used for testing the back of saw to see if it has the proper line. "H" is a set of bracket rollers for holding the upper side of the saw when placed above the bench, and "I" is a set of floor rollers to carry the under side of saw when placed below the bench. The rollers "J J" are held by adjustable brackets and placed one at each end of the bench as shown, and so arranged that they can be raised or lowered to meet the ends of saw when it is placed either above or below the bench. The dotted lines represent the position of saw when placed above the bench and the saw and rollers when placed below the bench. "K" is what is commonly known as a cross pean hammer and "L" a round faced or dog faced hammer.

CONSTRUCTING THE HAMMERING BENCH.

The first and one of the most important things to be considered when constructing a bench is the height, and this should be governed by the height of the operator, it being

necessary to bring the saw to a position where he can have a good view of the work without stooping or bending the back too much. A low bench will soon give an operator the backache, and one that is too high will tire the arms. A very convenient height is to have the surface of leveling block "C" even with the elbow, but if the operator is much under the average height it will be well to construct the bench at the proper height, and then provide a foot board to raise the operator to a comfortable position for working. If the bench is too low, you will find when the saw is placed below, the ends will spring up so far that the blade will not lay smooth and true on the face of block. The bench must be supported by wall brackets so that the saw can be placed around it without coming in contact with any obstruction. The block "C" should be placed parallel with the bench about the center endways and four inches from the front edge. This four inch space in front of block should be filled with a strip of hard wood to within $\frac{1}{8}$ of an inch of the face of block and in this strip set the three iron pins "E," "F," "G." See that the ends are $\frac{1}{8}$ of an inch higher than the surface of block "C," and dress them so as to form either a straight or curved line,

whichever you prefer to carry on the back of saw. The roller "B" should be placed two feet from the right hand end of bench for a right hand operator, and two feet from the left hand end for a left hand operator. Set the roller so that the top side of lower roll will be even with the face of block "C." Place the anvil "D" close to the end of leveling block "C," and be sure that the face of anvil is just flush with the face of block. Next, set in the wood fillers "M" "M." They should be of the same width as the block "C," and their surface brought just even with that of the block so that when the saw is laid on the bench it will have a true, even support the entire length. Place the bracket rollers "H" 3½ feet above the surface of block "C," and be sure they are lined true with the bench, then set the floor rolls in the same careful manner. Now place the adjustable bracket rolls "J" "J" so that when the saw is laid above the bench the space between rollers will be six inches greater than the entire length of saw. The object of these rollers is to push the idle side of saw around whenever the side on which you work is moved, and thus automatically hold the planks as shown at "N" "N." The surface of these planks should be even

with that of the block "C." They are used for holding the ends of the saw when placed above the bench, and should be arranged in such a manner that they may be easily and quickly taken out of the way when it is found necessary to place the saw below the bench. You now have the bench ready for work, and we will endeavor to give a short description of what is required in the way of filing room machinery:

THE BAND SAW STRETCHER.

This machine should be sufficiently strong to prevent any tendency to spring while the saw is being passed through the rollers. The shafts carrying rollers should be geared together at one end, so they will both move at the same speed at all times. They should also have an adjustment for lining, and be so set that when the pressure is applied, the shafts will stand exactly parallel, and if it becomes necessary to roll thicker or thinner saws, see to it that the alignment of roller shafts are changed to correspond with the thickness of saw. The rollers should be of exactly the same size, stand just plumb one over the other,

and have a true straight face $\frac{3}{8}$ to $\frac{1}{2}$ inch wide. Do not use a crowning or round face roll, for it is impossible for them to do good work. The object in rolling a saw is to stretch or expand the steel through the center of the blade and make the edges tight, and if a straight faced roller is used it tends to stretch the steel endways and not crossways, and will leave the blade as true and level as it was when you started to roll it, but if a round faced roller is used it tends to stretch the steel crossways, which is not the object sought and it will also warp or dish the blade in such a way that it will require considerable hammer work before it is straightened, and even then when the saw is put to work it is much more apt to buckle or dodge than it would have been had the blade never been dished. In rolling wide saws it is well to use a machine so constructed that the rollers may be shifted across the saw, but on small narrow saws this is not necessary. The manufacturers are now making a combined roller, retoother and shear, which is a very convenient machine and should find a place in every well equipped mill.

AUTOMATIC BAND SAW SHARPENER.

This is the most important machine in a filing room, and great care should be taken to select one that is properly constructed and capable of doing good work. The emery wheel arbor should stand just plumb over the saw blade and in line with the blade while the saw is being ground. The gate carrying the arbor should be adjustable to any point between a plumb line and an angle of 45 degrees to provide for the variation of hook carried in different mills. The arbor should also be adjustable on the gate and the back end set about $\frac{1}{4}$ of an inch higher than the wheel end. This will prevent a shoulder forming on the emery wheel where it comes in contact with the point of tooth. The machine should be provided with front and back feed and post brackets for holding a saw to position. The feed should be strong and uniform and the feed finger provided with adjustable stop for taking up slack or lost motion. The arbor and countershaft should be provided with a set of cone pulleys so that the speed of arbor may be increased or diminished as the emery wheel may require. Speed of a 12″ emery wheel should be about 1850. That of a 10″ 2200, and of an 8″

2750 revolutions per minute. It is very essential that the emery wheels have the proper speed to obtain the best results. If the speed is too slow the wheel wears too fast.

BAND SAW LAP GRINDER.

This machine must have a true finished table, provided with a clamp for holding the saw in position and a screw adjustment for changing the bevel. The emery wheel is mounted on a gate, which slides endways, and the arbor is provided with an end movement so that the wheel may be worked back and forth across the lap as it is being ground. The machines are made to work either by hand or automatically, there being no difference in the quality of work, but the automatic machines save considerable time and labor for the filer. We will advise that you use the emery wheel grinder in preference to any other machine, for we believe they will do better work with less trouble and expense than any other machine on the market.

BRAZING CLAMPS.

This machine should have a true planed surface, the width of saw and about five feet in length, with a straight edge at the back for

holding the ends of saw in line while it is being brazed. This straight edge should extend from each end of the table to within nine inches of the center. Always leave the edges of saw free for at least 18 inches where the brazing irons are clamped on, for if the straight edge extends to or near to the brazing irons the heat will expand the steel and shove the ends out. Then when the saw cools, you will find it has a hollow back where the braze was made. It will then require considerable extra work to bring the back of saw to its proper line. The machine should be provided with small side clamps for holding the saw in position and a power center clamp adjustable on both sides for pressing the irons to saw while making the braze.

BAND SAW FILING CLAMP.

This clamp should be about five or six feet in length with iron jaws, planed to a true line and be provided with a quick means of clamping and unclamping by a single movement of the foot or hand, as the case may be.

LEVELING BLOCK.

The leveling block should be about five feet in length by three or four inches thick, and

the width of the saw, planed to a true surface on both sides. It can be made of ordinary cast iron or have hardened faces as the operator may prefer, but wood of any kind should never be used, as it is next to impossible to keep it in shape for doing good work. While using the iron block it should be turned over occasionally and the work done on both sides to prevent it being drawn out of shape.

SAW ANVILS.

An anvil should have a true face, and tempered very hard, and be sufficiently heavy to resist any blow it may receive. Its dimensions are immaterial, and should be governed by the wish of the filer.

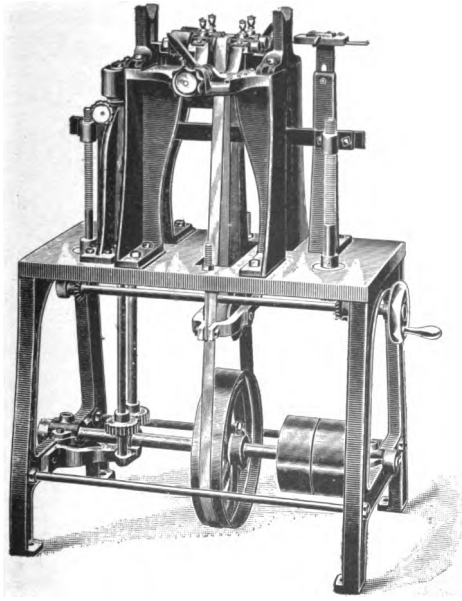
BAND SAW SWAGE.

A swage is a very important tool, and great care should be taken to select the best on the market, and then be sure to keep it in good repair. The machine should be so constructed that the anvil can be adjusted independent of the die or the die independent of the anvil. You will find this movement very important when it comes to adjusting the machine to different forms of teeth and for doing different

kinds of work. See that the machine is strong and well made to provide against wear and liability to get out of adjustment.

SWAGE SHAPER.

This important tool must be so constructed that it will draw the points of all the teeth to a uniform gauge, and bevel them back and under, so the corners and face of teeth stand



CUT No. 93

out very prominent, and there is no chance to form round edges. The Ideal Side Dresser and Jointer is very desirable in a filing room for the reason that it will side dress a saw perfect. See cut No. 93, page 23.

Band Saw Hammers are usually put up in a set of two, one with a cross pean, and one with a single round face. They should weigh about 2½ lbs. each, and the cross pean be provided with face ⅝x2 inches, slightly oval crossways, and rounded a little at the ends, the long way. One pean should stand parallel with the handle and the other on the opposite side at right angles to the first. The round faced hammer has but one face and this should be slightly oval on all sides. Avoid hammers which have too sharp a face, for they are sure to cut the steel and leave bad marks where the hammer strikes.

TENSION GAUGE AND STRAIGHT EDGE.

It is very convenient to have a combination straight edge and tension gauge—that is, to have the straight edge on one side for leveling, and the tension gauge on the other side for testing the tension. Great care should

be taken to have one side true and straight and the other must be curved to a true circle, and the amount of tension you wish to carry. This varies somewhat in different mills, but is usually somewhere from a 16 to 19 foot radius. An 18 foot radius is a very desirable tension for 14 gauge saws, but for 16 gauge would use the 16 foot radius. Then, bevel the corners on edges, so there is only 1/32 of an inch left straight. This will permit the light to show where there is the slightest opening when the gauge is held at right angle to the blade.

FORGE FOR HEATING BRAZING IRONS.

The most essential feature in the forge is to have a long draught opening so you will be able to keep a fire the full length of irons, and secure a true and even heat. You will find this very difficult to accomplish with the small forges having a round draught opening, found in some mills. Having thus fully described all the machines and tools necessary for taking care of band saws, we will now give the necessary instructions for their use. Beginning with the tensioning and treat every

branch of the work in its proper order until the saw is ready for its work and the mill in proper condition to receive and carry it.

TENSIONING THE BAND SAW.

Before you undertake this work we wish to warn you at the very beginning of the common error of all new beginners—that is, that they work too much, and in a reckless manner, and in this way soon become confused and get the saw in such a condition that it would require hours of hard work by an expert to undo the mischief they may do in a few moments. We wish to impress on your mind the necessity of starting in the most careful, painstaking manner. It is far better to err by doing too little than too much work, for if the stroke given has not been quite sufficient to accomplish the desired result, you can go over the work a second or a third time until the defect is removed, and you have not got yourself in any serious trouble, which you might easily do by working too heavily. Examine the blade very carefully and be sure of the nature of the defect and the means of removing it before you attempt to work. Never pass a saw through the roller or strike

a blow with the hammer until you are sure a defect exists and what effect the work will have which you are about to do. Then by going carefully and watching results closely, you will soon be able to judge to a nicety the amount of work required to accomplish the desired result. This knowledge can only be acquired through actual practice and experience.

WHAT IS TENSION?

Before starting the work it is very important that you should fully understand what tension is and the means of obtaining it. Webster's Dictionary tells us tension is "the act of stretching or straining," or "the state of being stretched or strained to stiffness," and this is exactly what it means when applied to the saw blade. The center of the blade is stretched and the edges strained to stiffness. The stretching is done by rolling a saw through the stretcher under sufficient pressure to expand the steel and leave it loose in the center and the edges tight, so while at work the principal strain is on the edges. This holds them very stiff and rigid and the saw is not liable to dodge or snake while making

a cut. This is what they call tension in a saw, and to determine just how much the edges should be strained the tension gauge is brought into use. This should be curved to a true radius. (See instructions for tension gauge on page 24.) Examine the stretcher and see that the rollers have from $\frac{3}{8}$ to $\frac{1}{2}$ inch straight face and stand just plumb, one over the other and that the roller shafts stand parallel when the pressure is applied.

Now place your saw on the bench (page 13), with the teeth from you, pass it through the stretcher with the under side resting on

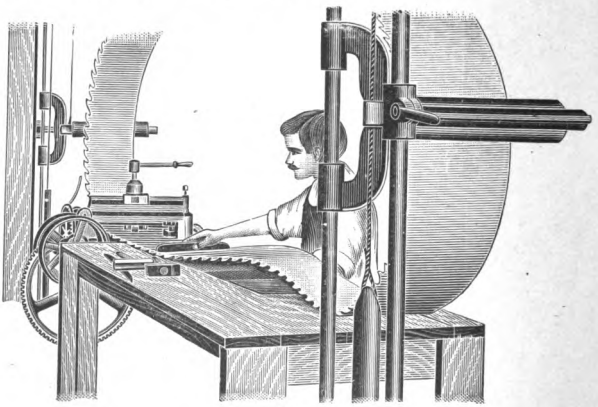


FIG. 2

Block "C," and the upper side supported on bracket roller "H." Set the supporting

planks "M" "N" in place and you are now ready to examine the saw for defects. Stand at the left hand end of Block "C," and lift the saw with the left hand about 18 inches above the bench and with the right hand hold the tension gauge across and at right angles to the blade, as shown in Fig. No. 2, page 28. Never hold the gauge on an incline, as it will not show the true condition of the blade while in an inclined position. Hold the gauge about the center of where the blade curves, and if it has the proper tension it will just fit the gauge from edge to edge, as shown in cut, and will not require any work. This is the way the blade should appear all the way round.

A FAST OR TIGHT CENTER.

Fig. No. 3, page 30, shows a saw in this condition. You will notice the center appears to be high, and the gauge rocks over it. This may occur in the center or at any point between the two edges, but always indicates a tight place, as all tight places will raise and loose places drop away from the gauge when a saw is held in the position shown in cut. Now follow this fast or tight place around the blade, until you have located it its entire

length, then mark the ends plainly with chalk and roll once over the entire length, as near as possible the center of where it shows tight; then examine the saw with tension gauge again to see if you have changed its condi-

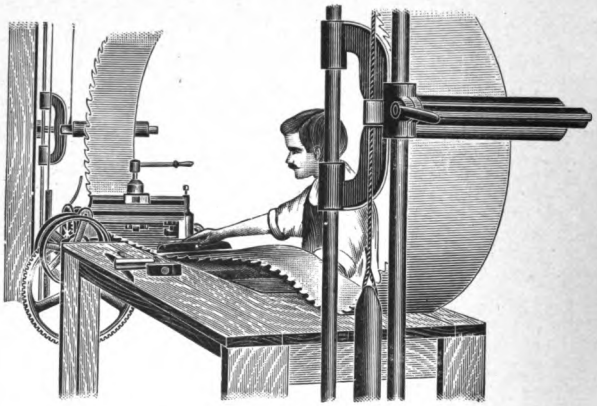


FIG. 3

tion. If not, the roller was not set tight enough, and it will be necessary to pass it through again with the rollers set tighter, and continue this operation until the defect is removed and the blade just fits the gauge.

A LOOSE CENTER.

Fig. No. 4, page 31, will show you a saw that has been expanded too much in the center and the edges drawn very tight. Take

notice how the center of blade drops away from gauge. If you were to hold a saw in this position where you could spring it first one way and then the other, the center would pass between the edges with a sort of snap or jerky motion, and if the saw was run in this condition a cracked blade would surely be the

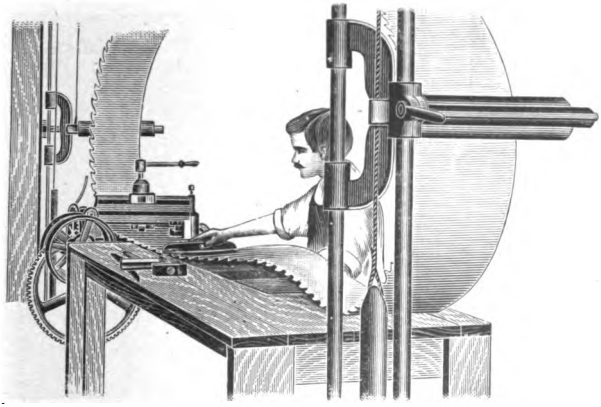


FIG. 4

result. It is also impossible to properly level or straighten a blade while it is so open in the center. To remove this defect and leave the blade so it will not crack requires very careful work. You should first examine the back of the saw to see if it has the proper line, and if you find it has, roll very light over the two extreme edges for the entire length

the blade shows to be too open, but if the back is not in line, roll the edge necessary to bring it to line, then examine the loose spot, and you will find it has disappeared. (See instructions for straightening back of saw.) Always be very careful in removing loose spots to commence on the extreme edge first, and from there work toward the center, for if you roll close to the edge without expanding the extreme edge it will straighten the back, but leave the edge so tight that when strained on the mill it is sure to crack.

STRAIGHTENING THE BACKS OF SAWS.

After working all the way around the blade in the manner described above, and it conforms to the tension gauge its entire length, then examine the back by bringing it out to the pins "E," "F," and "G." If it just touches all three pins at the same time it is all right, but if it lies against the two end pins and does not touch the center, it shows what is called a tight or hollow back, and to remove this defect the saw must be expanded on the back edge. You should push the saw along about 12 to 18 inches and examine it

again and continue this operation until you have located the hollow in the back its entire length. Then mark it plainly with chalk at each end about 12 inches short of where the back comes to its true line, then set the roller so it passes over the extreme edge, and roll very light the entire length between chalk marks. It will not take more than one-half the pressure to move a saw on the edge that is required to move the center of the blade. Now examine the saw with tension gauge. If you find tight spots back from the edge remove them. Then try the back. If it does not come to the line, pass it through the roller again about one-half inch from the edge and continue this operation, always working back from the edge, until the back drops to its proper line, then try the blade with tension gauge and if there are tight spots, remove them by passing the saw through the roller, as instructed under the heading, "A Fast or Tight Center." If the back of saw should lie against the center pin and does not touch the end pins, it shows that the back is loose or long and you should lay out the tooth edge and pass it through the roller, the same as instructed on back edge for removing a hollow back; then even up the tension and con-

tinue this work until the saw lies against all three pins its entire length and the blade shows the proper tension. The saw will then be ready to level, and you should proceed as follows:

LEVELING A BAND SAW.

First, place the saw around the bench, so that the work is done on the log side; see that the blade lies true on the face of the block without any tendency to spring over high or uneven places. Then with a good true straight edge, the same length as the width of the saw, examine the blade, holding the straight edge lengthwise. If you find any lumps, use the cross pean hammer on the high places, holding the hammer in such a manner that the long face of the pean is just square across the blade, for if used at an angle it is apt to throw a twist in the saw. Strike very light blows and use the straight edge often to see when the lump is removed. If you strike too hard, or too many blows, it will drive the steel through and the lump will appear on the opposite side. Work carefully all around the saw in this manner. Then place it above the

bench and go over the inside in the same manner; then, without changing the position of saw, work around it a second time, holding the straight edge across the blade and use the hammer on all high places until you secure a true flat surface from edge to edge. While leveling the saw crossways, the hammer must be held so that the long way of pean stands parallel with the blade. After working over the entire length of the inside in this manner, then place the saw around the bench again and level the log side crosswise, holding the straight edge across the blade, watching close for lumps and buckles near the edges. Use the hammer on all high places as instructed above. In leveling always commence on the log side and finish your work on the same side. The reason for this is that saws are more apt to crowd out of the log than they are to draw to the log and you will also notice that lumps and buckles appear on the log side much more frequently than they do on the inside, and one should always be sure that the log side of saw presents a true, even surface. It will then stand a strong feed without any tendency to draw or snake while in the cut.

A TWISTY SAW.

Twists in a saw are generally caused by some unusual strain such as being pulled off the wheels running, or the saw may have been

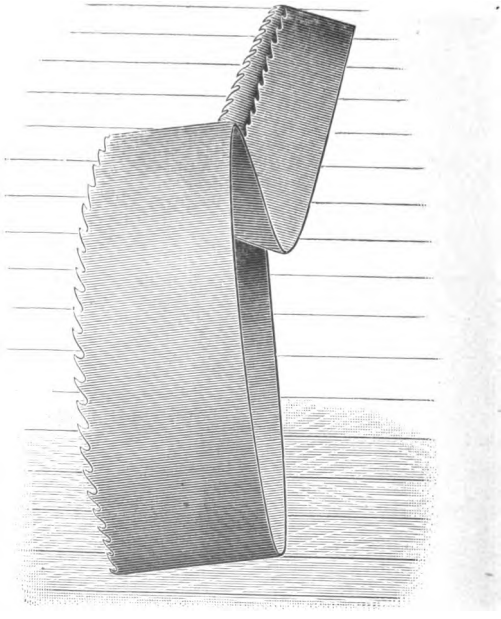


FIG. 5

cramped or bound in the cut in such a manner as to pull the tension out in places, or a sliver will sometimes get caught in the guides and heat the saw on one edge. The uneven strain

thus produced will cause the saw to twist, so when laid on a level floor one end will lop or incline in one direction while the other end draws to the opposite direction. This shows

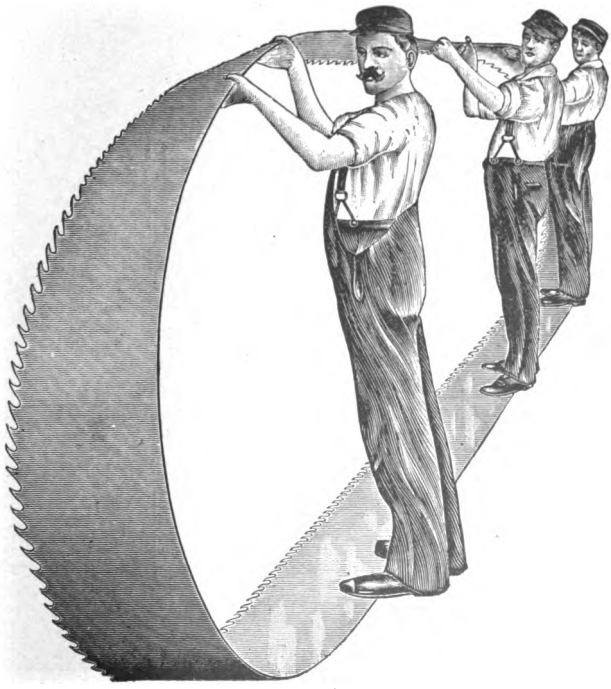


FIG. 6

a twist the whole length of blade. Fig. No. 5, on page 36, will show you a saw in this condition. To remove this defect place the saw

on the bench and even up the tension and straighten the back in the usual manner. Also level the saw lengthwise and crosswise and if done in a careful, thorough manner, this will usually take out the twist, for it is the uneven strain and buckles that causes the saw to twist. After the saw has a proper tension, is level and straight on the back and still shows the twist when laid on the floor, take hold the back of saw at the end where it inclines toward you, then have two helpers hold up the upper side of saw, as shown in Fig. No. 6, page 37. Now stand on the under side of saw in such a way that you hold the back of saw on the under side close to the floor, then with your hands thrust the upper side from you and while in this position let the saw roll on the floor. Keep moving around on the under side and crowding the top side from you until you have worked the entire length of blade. Then step back and allow the saw to lie loose on the floor. If it still shows a tendency to twist, repeat the operation until you have taken all the twist out of it, then take it back to the bench and examine the tension and back. Make sure they are in proper condition and the saw will then be ready for use. Twists are also caused

by carelessness in leveling, by not holding the pean on hammer at the proper angle, and if caused in this manner they can be removed by doing a little work in the opposite direction, or if extending the full length of blade, they may be taken out as described above.

SHORT LENGTH TWISTS.

If a blade shows twisty for only a short length, use the straight edge and hammer, always applying the blows on the highest places and so that the long way of pean is exactly parallel with the way the twist runs and continue this work until the blade lies straight and flat on the block.

SWAGING THE BAND SAW.

The amount of swage necessary to carry depends very much on the kind of wood to be sawed. For sawing white pine, basswood, cottonwood and other woods during the summer time, the saw should be swaged from four to five gauges wider than the thickness of the blade, but for all hardwoods or frozen timber, from three to four gauges of swage is plenty. Great care sould be taken in swaging to have the machine work just right. If the

die comes in contact with the tooth too far from the point, it will spread wider below the point than it does on the point, and so form round corners. It is also apt to split the point of the tooth. Then if the swage works too close to the point it will spread nicely, but leaves a slim, needle-like corner, and sets the point of tooth back much the same as an upset. It will then require considerable grinding to get the tooth back to a slim easy-cutting point, but there is a point between these two extremes where the dies may catch the tooth and give it a full spread, the widest on the extreme point, and taper from there down in such a manner as to form a strong substantial corner that is not easily broken off. This is the point you should endeavor to find, and, once found, keep the machine working there. In ordinary band swaging, the lower die should strike the tooth about 3/16 of an inch below the point and spread full from the corners. It should also draw the tooth forward, so when grinding the wheel will face the point of the tooth before it reaches the old line of grinding at the base. This is especially necessary when carrying an extreme hook in order that you may be able to hold the form of tooth. If you have a good swage so that

the dies may each be adjusted one independent of the other, this may easily be accomplished and you will be able to swage and hold any form of tooth you may desire. Never spread the points of teeth more than 1 to 1½ gauges wider than you shape, for if spread too wide and the shaper has considerable steel, to force it back in place, it will sort of fold the steel and the corners will become weak and liable to crumble.

SHAPING THE POINTS OF TEETH.

For this purpose you should always use some good pressure swage shaper that will bevel the point of tooth back and under so as to insure full sharp-cutting corners. A file side dress will not do this work properly. The points of teeth should be evenly spread 1 to 1½ gauges wider than the set you wish to carry, then place the shaper on and draw it up snug. It should leave all the points of the teeth shaped to a true gauge. Then go around the saw with a side gauge and tooth-straightener and straighten any teeth which may have been bent or sprung to one side. If you have an Ideal Side Dresser put saw in this machine

and let it run through 2 or 3 times, which will make sure that the teeth are even on both sides, after which the saw will be ready to grind.

GRINDING A BAND SAW.

First see that the saw is in the proper position, that is hangs free in the filing clamp and post brackets. The front and back feed fingers in their proper places; then start the machine and after the feed fingers have passed over a few teeth, take hold of the lever, and lower the emery wheel carefully, and adjust until it grinds lightly over the face and back of teeth and continue the grinding until all the teeth are ground to a sharp point from both front and back. If the machine works well it will not be necessary to use a file. The wheel leaves a more true and nicer cutting edge than it is possible to secure with a file. The saw is now ready to be carried to the mill and we will give a few instructions in regard to adjusting and keeping the band mill in order.

LINING THE WHEELS WITH TRACK.

First line the lower arbor with the V-shaped rail of carriage track, giving it a lead

in the log of 1/16 of an inch in 16 feet; then line the upper arbor parallel with the lower arbor and set the upper wheel plumb over the lower wheel. Now place the saw on wheels, and put the strain on; then start the mill slowly and tilt the back end of upper arbor until the tooth-line of saw runs over the front edge of wheels about ¾ of an inch; then stop the mill and examine upper and lower wheels to see if the saw runs the same distance from edge on both wheels. If not, the wheels do not stand plumb, and the arbors should be adjusted endwise until the saw runs alike on both wheels. Then adjust the guides. This should be done by first setting the guides so the edge of front guide pins will just come to the base of tooth line, then adjust the guide pins sideways until they touch the blade, but be careful not to bind the saw between guide pins. See that the scrapers are properly adjusted on upper and lower wheel and the mill is then ready for work.

HINTS TO THE SAWYER.

A good sawyer will always give the saw a strong, steady feed—all it will stand and do good work, and no more. Watch the saw carefully while in the cut and if you find it

has a tendency to crowd back, tilt the arbor so as to carry it a little farther ahead. But if the saw should move ahead on the wheels while making a cut, tilt the arbor so as to run it farther back. A good running saw, rightly managed, will always hold the same relative position to the wheels, regardless of whether it is running empty or making a cut. See that the guides are always in proper adjustment, the wheels clean and smooth, the bearings well oiled, and you will then have a nice running mill.

If you wish to test a saw to see if it has the proper lead, secure a fair sized log and after it has been slabbed, feed through, cutting off a board with the average amount of feed, then gig the carriage back and without setting the log ahead, feed through a second time very slowly, watching the saw very carefully. If it is crowded out on the first cut, it will shave off a thin piece as the log passes slowly through the second time, but if the saw draws in on the first cut, it will not touch the log as it passes through the second time. If the lead is just right and the saw running straight, it will just brush the side of the log all the way

along, but in case it does not, you should not attempt to hold it one way or the other by shifting the guides.

The guides on a band mill are to steady the saw and holding it from getting out of place, not for holding it to place, and we do not believe in getting into one difficulty in order to overcome another. The trouble lies either in the alignment of the arbors with the track, or the saw is not in proper condition for the work. Find out where the trouble lies and remedy it there, and you will then be rid of it, but if you attempt to shift the guides or counteract the defects in any manner, it will always be a constant source of annoyance and greatly reduce the quantity and quality of the lumber cut.

If the saw should become hot from any cause while in use, do not attempt to put a cut on it until it has become thoroughly cool for the heat changes the tension and if the saw is put to work while in that condition it is sure to snake and that will cause it to heat a second time and continue to do bad work, but if allowed to cool, the steel will usually contract to its former position and the saw

will then do good work, but if it does not, take it off the wheels and send it to the filing room to be fixed.

Never continue to use a saw that is working bad, for it will grow worse instead of better and require considerable more work to put it in shape than it would if it had been taken off in time, and when a saw is working bad there is a strong pressure on the guides, which in time causes the saw to crystallize and crack. A good sawyer will always watch a mill closely and be quick to detect anything that is not in good working order.

The carriage is equally as important as the band mill and should always be kept in the best possible condition. See that it is provided with scrapers and sweepers, which keep the track clean at all times. If the carriage is allowed to run over obstructions on the track it causes it to lift and the log to sort of twist or bind the saw, and this will cause it to run bad and make poor lumber. The surface of the blocks on which the logs rest should stand exactly at right angles to the saw blade and be at least 2½ or 3 inches above the top of the lower guide, so that in case the log is a little

crooked or there is a knot on the under side, it will not ride the guide as the log is being fed through.

The offset should be quick and positive and the track perfectly straight. The best place for a sawyer to stand is in front of the mill, as it affords a much better opportunity to watch the mill and carriage than can possibly be secured if he stands behind the mill. We would advise that the levers be placed in front of the mill, and connected so that the line of motion on the feed lever crosses that of the carriage at right angles. This will allow the sawyer to stand facing the carriage and a pull on the lever should feed the carriage ahead while a shove gigs it back. The advantage claimed for this arrangement is as follows:

By standing in front of the mill, the sawyer has a better chance to watch the position of saw on the wheels, and while in the cut. It is only necessary to simply turn the head in order to have an unobstructed view of the mill, carriage, log deck or nigger. The connections from nigger to controlling lever are much shorter and more simple, thus causing that machine to work better.

Another great advantage gained by standing in front is the fact that the sawyer can see both ends of every log and be able to work the timber to better advantage. He is not in the way of the tail sawyer nor is the tail sawyer in the way of the head sawyer, as is apt to be the case when the head sawyer is stationed behind the mill.

PREPARING A BRAZE.

Be careful to cut the saw square across and in such a way that the lap will be between two teeth when brazed, the space will be equal to that of the remainder of the teeth on the saw. Then true the ends up nicely and draw a line three-quarters of an inch back on the outside at the end where the teeth point toward the end and on the inside at the end where they point away from the end. Then leave the ends so they are true and straight. A 14-inch gauge saw should be lapped $\frac{3}{4}$ of an inch and a 16-gauge saw or thinner $\frac{5}{8}$ of an inch.

DRESSING THE LAP.

For this work it is best to use a good emery wheel lap grinder. See that the saw is clamped square with the wheel, and that the

wheel travels true with the surface of the table on which the saw rests. Then grind the ends to a feather edge and on a true bevel back to the line which you drew from $\frac{3}{4}$ to $\frac{5}{8}$ of an inch from the ends, according to thickness of saw.

At first the emery wheel may be applied with considerable force, but while finishing it should touch the steel very light and should be worked back and forth across the lap to insure a true, even surface. Do not use too coarse an emery wheel or if you do use a coarse wheel to do the heavy grinding, change it to a fine one for finishing the work. If you have a good machine and it is properly handled, it will leave the lap so true that when the ends are placed together they form almost an invisible joint, and this is very essential to making a good braze. Never file the lap after it leaves the dresser, for it is almost impossible to file it true, and the machine should leave it in much better shape than you could dress it by hand.

HOW TO CLEAN THE LAP.

After you have finished grinding and before placing the saw in brazing clamp, clean the ends good with powdered borax or muri-

atic acid. Either will make a good braze if properly used, but the muriatic acid has a great tendency to rust the screws on the brazing clamp or anything it may come in contact with, and the powdered borax makes just as good a braze and will not rust anything, so for this reason we would advise the use of powdered borax.

One of the most important points is to be sure that the lap is free from oil or dirt in any form, and it is well to wash and wipe your hands just before you start to clean the lap, so that in case your fingers come in contact with the steel they do not leave a dirty spot. Then take some of the borax in your hand or a clean piece of cloth and rub the steel thoroughly with it until all traces of oil or dirt are removed. Then take a strip of the best silver solder the length of the braze, and as wide as the lap and clean well with borax.

PLACING THE SAW IN THE BRAZING CLAMP.

First see that the clamp is properly adjusted and the brazing irons have a straight, true surface and even thickness the entire

length, then adjust the lower side of the clamp so that when the iron is shoved in the top will just come flush with the surface of the brazing table. Leave the upper side of the brazing clamp high enough so the iron can be set in place without any delay or danger of moving the saw blade, then place one end of the saw in the clamp, move the lap just to the center of where the brazing irons are to be applied, see that the back is snug up to the straight edge, and set the small side clamp to hold it in place. Then sprinkle a very little of the powdered borax on the lap and see that it is evenly distributed over the entire surface. Then bring the other end to place and be careful to set it so the teeth are spaced exact and the back is firm against the straight edge. Then set the side clamp to hold it to place. Next take the strip of solder previously prepared and sprinkle a small amount of borax over the top side and place it between the lap.

HEATING THE BRAZING IRONS.

The forge for heating irons should have a long draft opening so you can get a fire the full length of the irons. Then place them in the forge and heat slowly to a bright red, being

careful not to burn them, but they should come almost to a white heat. Then take them out and scrape off the scale with an old file or other suitable instrument kept for that purpose. Then place the iron on the under side of the saw first. Next bring the top iron to place, see that they are centered and square across the saw and screw down the clamp; the center screw first, then the end screws and loosen the side clamps to give the saw a chance to expand. All this should be done as quickly as possible after you start to place the irons on the saw. Then stand by the clamp and continue to tighten the screws as the irons cool until they turn black, then loosen the clamp and remove the irons. We would advise the use of soft steel 1½ inches wide by ¾ inch thick for making a braze instead of iron. It will take a more uniform heat and does not scale nearly as bad as iron.

STRAIGHTENING THE BRAZE.

After the irons have been removed and the saw becomes cold, you will find the braze is badly warped and buckled. This is caused by the uneven strain and expansion caused by clamping the hot irons to the blade. You

should take the saw to the bench and file off any particles of solder which may have been left on the outside. Then if the lap is any thicker than the balance of the blade, dress it to the same gauge or a little thinner. Then draw lines across the braze with chalk about 1 inch apart and within 2 inches of the edges. Then roll, under the ordinary pressure, once over each line as far as the steel is discolored by the heat of the irons, then go over it again, and roll between the lines, then try the saw with the tension gauge and if it shows a little tension, level with the hammer and after you have the braze leveled, try it with the tension gauge and roll any spot found stiff until it shows the proper tension, then examine the back to see if it has the proper line. If not, straighten it as instructed on page 32. After the back is straightened and the blade shows the proper tension and is level, take a piece of emery cloth and polish the braze until it is smooth and bright. Then roll the saw around the bench and when the braze comes back to the leveling block you will find it needs more leveling and you should continue passing the saw around the

bench and leveling the braze until it will lay straight after it has been sprung around the ends, and the saw will then be ready for use.

SPEED OF SAWS.

The speed at which a saw should be run depends somewhat on the kind of timber to be sawed and the amount of work it is required to do. If the wood is soft, and you wish to crowd the saw to a large capacity, a rim speed of 12,000 per minute is not too much, but for this speed the saws must be kept in first-class condition, have a nice even tension, and be free from buckles and lumps of any kind, but if you only require a moderate capacity, then we would recommend 10,000′ per minute rim speed on soft woods and 9,000′ per minute on hard woods or frozen timber.

SHAPE OF BAND SAW TEETH.

There is only one proper shape in which to dress the teeth on all rip saws, and that is to have the back of the teeth as full as possible, and clear the timber and the face cut under as much as possible without making the teeth too slim. (See Fig. No. 7, page 55.) This makes a very easy cutting tooth and works equally well in all kinds of timber. It has

been truly said that if one was to examine the saw teeth in one hundred different mills, they would find one hundred different forms, but this ought not to be. There is some one form which must work better than all others and that is the form which all mills should

FIG. 7

use. Saw makers would then have a standard to work to and the makers of filing room machinery could send out their machines properly adjusted and ready for work, but there is such an extreme variation in the shape and spacing of the teeth that it is almost impossible to make a machine that will work well on all the different forms, and it is certainly impossible to send out a machine in anything like the proper adjustment, for one can never tell what form of teeth it may be used on. This makes it necessary for the filer to refit cams and adjust the machine to suit himself and if he has not had considerable experience in this line of work, he is not apt to get it right and the machine does not work

to the best advantage, but a standard form of tooth would do away with all this and make it much easier and more pleasant for all concerned.

We will all agree that the more hook you give a saw tooth the easier it cuts, and if this is true, it necessarily follows that the easier a saw cuts the more apt it is to run straight.

It is when a saw is cutting hard that it buckles and tries to dodge around the hard places. A saw that is gummed straight or nearly straight, in from the edge forms more of a scraping than a cutting edge, and becomes dull very quickly. A saw cut under on about an angle of 45 degrees will run five hours and still be in better condition than one with the teeth cut nearly straight will be at the end of one hour's work. In scraping over a piece of timber with an edged tool, the tool becomes dull very quickly, but if it strikes the timber at an angle of 45 degrees it cuts very easy and may be used for a considerable length of time and still be in fair condition.

SPACE OF TEETH.

The spacing of saw teeth must be governed somewhat by the kind of wood to be sawed and the amount of work you wish to do. When

a saw is in good shape, and the teeth properly dressed, each tooth will stand an average feed of 1-32″ in hard woods, and 3-64″ in soft woods and do good work. If you wish to carry a quick feed, space the saw teeth as close as possible and maintain the hook shape and depth and then run the saw at a high speed, but if it only required to do a moderate amount of work or if the power is not sufficient for fast work, then space the teeth farther apart. It is better for each tooth to do a fair amount of work, as the saw will drive easier and stay sharp longer when the teeth are cutting than when they are merely rubbing against the timber.

AMOUNT OF STRAIN NECESSARY FOR BAND SAWS.

Every band mill should be so constructed that one can easily tell at any time how much strain there is on the saw and the straining device be sensitive enough to maintain the same strain regardless of whether the saw is making a cut or running empty. It is only necessary to carry strain enough to cause the saw to run true and steady and not slip on the wheels, and the amount of strain given in the following table for various saws in common use is all that is necessary for this purpose.

Table of Strains to Different Widths and Gauges of Band Saws.

Gauge	WIDTH OF SAW.														
	2½	3	3½	4	4½	5	6	7	8	9	10	11	12	13	14
21	700	800	900	1000	1150	1250	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	900	1000	1100	1200	1350	1500	1800	2100	.....	.....	.....	.....	.....	.....	.....
19	.....	.....	1300	1400	1500	1700	2000	2300	2800	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	1550	1700	1900	2250	2550	3000	.....	.....	.....	.....	.....	.....
17	.....	.....	.....	1700	1900	2100	2500	2800	3200	.....	.....	.....	.....	.....	.....
16	.....	.....	.....	.....	.....	2400	2700	3000	3500	4000	4500	5000	5500	6000	6500
15	.....	.....	.....	.....	.....	2800	3100	3500	4000	4500	5000	5500	6000	6500	7000
14	.....	.....	.....	.....	.....	.....	.....	.....	4500	5000	5500	6000	6500	7000	7500
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7000	7500	8000	8500

WHY DO BAND SAWS CRACK?

There are but few users of band saws who understand the true cause of this difficulty. A great many think it is caused by the saw bending over the wheels. But this is not true for a saw will stand to be bent to a much smaller circle than the wheels in common use without injury and after a saw has been run a short time, the outside becomes stretched and it conforms to the curve of the wheel very easily, but the true cause of cracks is the fact that the steel has been strained beyond its strength at the place where the cracks appear, and this overstrain may be caused in several different ways, but one of the most common causes is running the tension too close to the edge. When rolling a saw 8″ wide for tension, you should not roll closer than 1½″ to the edge, and on saws 12″ to 14″ wide there should be at least 2″ tire left on each edge.

A great many filers cause a saw to crack while straightening the back. They roll close to the edge without stretching the extreme edge. This will straighten the back and not affect the tension very much, and they seem to think that is all that is necessary, but this

method of straightening leaves a little strip of steel on the edge which was not expanded so tight that when strained on the wheels, and it receives the force of a cut, it is sure to crack. When straightening the back of a saw or taking out loose spots, always commence on the extreme edge and work from there towards the center of the blade and you will then not be troubled with the saw cracking on the edge. It sometimes happens that a narrow strip of steel back from the edge is left very tight and this will cause what is known as center cracks, or if the band mill wheels are very crowning or badly worn on the front edge, they will also cause center cracks. A band mill made in such a way that the tension balance is not sensitive, may cause saws to crack and will also greatly reduce the capacity of the mill.

Sometimes when a saw dodges in the cut or the log becomes loose on the saw, it produces such an unusual strain on the blade that the steel is pulled in the tight places. A saw that has been long in use is apt to become crystallized or if metal guides are used, they will in a shore time crystallize a saw and the steel

becomes brittle to such an extent that it will no longer stand the usual strain and cracks follow.

If saws are made of good steel, well tempered, and the filer is careful to keep them well tensioned and level, also to keep the band mill and wheel in good condition, they should last until they are worn out without cracking.

SPEED OF EMERY WHEELS.

It would be impossible to give a speed which would be right for all wheels for there are so many different grades and what would be right for one, might not be right for another, so it is necessary that all emery wheel saw gumming machines should be provided with a set of cone pulleys, so that the speed may be changed to suit the wheel used. A hard wheel should be run slow and a soft wheel fast, and as the wheel wears the speed of the arbor should be increased, so as to maintain a rim speed of about 5,000′ per minute. If the wheel glazes at this speed, reduce it, but if it appears soft and scrapes away easily, increase the speed until the wheel works satisfactory.

DOUBLE CUT BAND SAWS.

Double cut or double edge saws require much more careful work and more frequent fitting than the single cutting bands. The principle of tension and leveling is exactly the same as that used on single cut saws, only it is necessary to be very careful to have them just right and see that the log side presents a true and even surface. Then while they are running, if they should strike a little gravel or become dull on the log side as saws are apt to, it becomes necessary to change and refit the saw at once or it will make bad lumber.

All the rules for rolling, straightening, and dressing the teeth on single cut bands will apply equally as well on the double cut saws. The machinery and tools used for care of these saws are very much the same as for single toothed saws, except the grinder and clamp. The grinder made for this purpose is made in two different ways. One is to grind the saw on both sides at the same time. The other way is to grind one side of saw, and when finished turn it over and grind the other side. The rules for adjusting these grinders are the same as for single toothed band saws.

BAND RE-SAWS.

Small band saws such as are used in factories or wood working shops for resawing boards or plank, require the same treatment as large band saws, only whenever the blade is 3″ or less in width, they will require very little if any tension. Always use a full swage on all rip saws, but saws for cross cut work should be fitted with a spring set. Be careful to spring the teeth very close to the point and keep the outside corner full and sharp and when dressing, bevel a little to the inside.

CARE AND MANAGEMENT OF CIRCULAR SAWS.

Circular saws are the most difficult to manage of any saw in use, and the filer in charge of them should be a thorough mechanic in every sense of the word as the work calls for close judgment and workmanship. The shape of the teeth, space of teeth tension and speed as well as the arbor and carriage must all be looked after and kept in first class condition in order to secure good work. A filer should watch the machinery as well as the saws and be sure everything is in good order, be careful to keep the track level, and straight, the

carriage free from lateral play, the mandrel lined true, with the track level, and free from all end play. The boxes should fit very close so there will not be any chance for the arbor to lift. The collars should be perfectly true, the power steady and sufficient to maintain a uniform speed at all times. The eye of the saw should fit the arbor close, but be careful that it does not bind for if forced to its place by the nut it is apt to dish the saw and cause it to run badly.

If the arbor is not true, never attempt to hold the saw to place by packing between the collar and saw with paper or other substance for it would always be a source of annoyance and it is far better to send the mandrel to a machine shop at once and have the collars put in shape to receive a saw. It is very important that the bearing on the arbor, next to the saw should run cool, for if it heats it will cause the saw to heat in the center and that changes the tension and causes it to run badly.

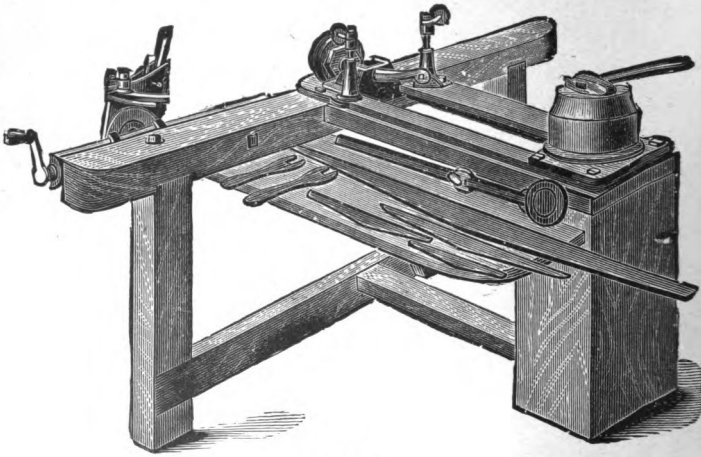
We will now commence with the hammering and treat every branch of the work in detail and if our instructions are carefully followed we know satisfaction will be the result.

HAMMERING LARGE CIRCULAR SAWS.

Always hammer in circular lines around the plate and not from the eye to rim for if hammered in straight lines from the eye to rim, it will require more work and the slightest difference in the force of blows upon the saw will produce an open and tight line running from the center to the edge, the effect upon the saw will be a rattling or trembling motion which causes the saw to run unsteady. If there is an open line running from center to rim, this line runs across the line of motion of the saw and is very apt to cause a buckle. If the saw is hammered in circular lines around the plate and there should be any one line expanded more than another, it will not effect the running of the saw as it would if it ran from center to rim.

It is best to use a bench like the one shown in cut No. 8, page 66. The principal features of this bench will be readily understood by observing that the saw is held by its center and held level by adjustable rests, causing the saw to lay true on the anvil. The saw can be revolved around and the blows applied more uniform in weight and the position of the

body remains unchanged, but when working from center to rim the body changes position with every blow and this will cause the blows to vary both in weight and distance apart. It is apt to be very difficult for new beginners to apply the blows at equal



CUT No. 8

distances apart with uniform weight. They should take such a position that the blows may be delivered in a line without necessitating a change in position. It is almost impossible to change position of body without it changing more or less the force of the blows. Be careful, follow instructions and the balance

will come through practice. It ought not to be expected that a new beginner in hammering saws, would secure the best results from the start, but they can greatly improve the running of saws, and the more perfect a saw runs the less power it takes to drive it. The percentage of loss, wear and tear on machinery is much less and more work can be accomplished, so you will see it is very important to have the saw and everything connected with it, just right.

The first step in order to make a success is to have a thorough knowledge of the tools required and how to use them and we will commence with

THE STRAIGHT-EDGES AND TENSION GAUGE.

Straight-edges should be made of steel 14 to 12 gauge in thickness, of a length suitable for the saw you wish to hammer, be perfectly straight and have a V shaped edge. Some use them with a square edge and hold it at an angle on the saw to admit of light under it, but while in this position it will not show the true condition of the saw. A straight-edge should be made in such a way that it will show the defects in a saw when held at

right angles to the blade. It is best to have a long straight-edge that will reach clear across the saw, for testing it to find buckles and twists, and a short straight-edge for leveling and taking out lumps.

The tension gauge should be made of 14 gauge steel with a V shaped edge curved to exactly fit the drop in saw when it has the proper tension, and is held by the rim in nearly a horizontal position, allowing the center to drop through of its own weight and holding the gauge on a true line, extending from the eye to rim. With this gauge you can work around the saw and it will show exactly where it is too tight or too loose as the steel appears high and the gauge rocks over tight places, while a spot that is too loose, drops away from the gauge. The tension gauge, like the straight-edge, should always be held at right angles to the saw blade. You should have a bench as shown on page 66, cut No. 8, and two hammers, a round face or dog head hammer, as they are commonly called, and a cross pean hammer, each weighing 3 to 3½ lbs. The round faced hammer is used for expanding and evening the tension and the cross pean hammer for taking out twists and buckles.

EXAMINING CIRCULAR SAWS FOR DEFECTS.

First, place the saw on bench, then take the tension gauge and examine it all the way around for tension. If you find the tension is not even, take the round faced hammer and expand the tight places until the saw fits the tension gauge all the way around, then with the cross pean hammer and straight-edge work out all the lumps and buckles. When the saws are very stiff and require considerable hammer work evenly distributed all around the blade, it is best to lay out the work as shown in Fig. No. 8, page 70, and number the lines as indicated, divide the saw in four equal parts from the center as shown by circular lines and numbers. These lines should be drawn on both sides of every saw to be hammered and if the instructions are followed, you will at times have occasion to refer to them. In laying out the saw, use hard soap or tallow, it being preferable to chalk and leaving a plainer mark.

When hammering for tension, the work should all be done between lines 1 and 3 and the same number of blows struck on each side as near opposite each other as it is possible to place them.

When taking out tension or removing loose spots, hammer the rim on both sides as far in as line 3, only strike a few light blows at a time and examine the saw with tension

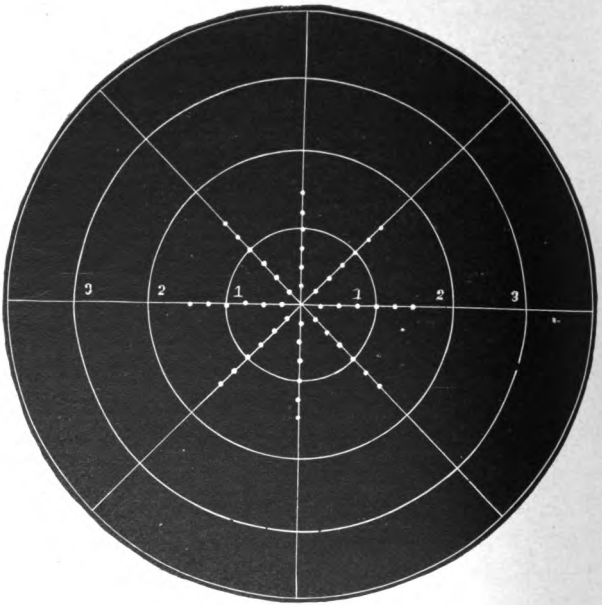


FIG. 8

gauge often to see when the defect is removed. Never hammer the saw inside of circle 1 except to straighten the saw in case it is bent and then use a pad on the anvil and you will

be able to straighten it without expanding the steel.

Circle 1 represents ¼ the diameter of the saw and should not be expanded or opened inside with the hammer. Keep this portion of the saw as stiff as possible. When the center is tight or stiff it acts the same as a large collar to support the saw without an addition of thickness. The center of the saw does not expand while running unless it should heat by the arbor becoming heated, or heating from any cause will expand the steel and if it had been hammered inside of circle 1, the heating will expand the center so much that it will cause the saw to dish and dodge either in or out of the log, necessitating the frequent moving of the guide, first one way and then the other in order to hold the saw in place.

Many sawyers have had such experience and did not know the true cause of the trouble. A saw that is too open in the center will make a great deal of thick and thin lumber. The amount of opening a saw requires depends entirely upon the speed at which it is run, but for a rim speed of 10,000′ per minute or less, it should be opened all it will stand and allow the center to drop through the rim easily of its own weight when the saw

is tipped to one side. To judge more closely when the saw is open sufficient for this speed allow it to stand upon its edge, balance it nicely between the fingers, then give it a sudden shake. If the vibration extends out beyond the 3d line and is true and vibration long, this will indicate it has about the right opening, but if it is too tight, this will become stationary at once, if too open, there will be a sort of snap or jerk to the vibration and the saw will come to a rest as quickly as though not open enough. These movements should be closely observed.

For a rim speed of more than 10,000′ per minute the saw will need to be open more, and the only way to ascertain just how much more, is by actual tests and when you have a saw just right for the speed and work it is required to do, make a tension gauge and be careful to have it just fit the saw which runs right and then hammer all saws to the same gauge and keep them level and true and they will all run alike. One should always use a tension gauge for all saws that require tension, for it will show the condition a saw is in much quicker than any other means; it also makes the work much easier for new beginners, for if the saw does not fit the gauge

they know it is not right, but with a straight-edge, there is more or less guess work even when used by those who have had long experience in saw hammering.

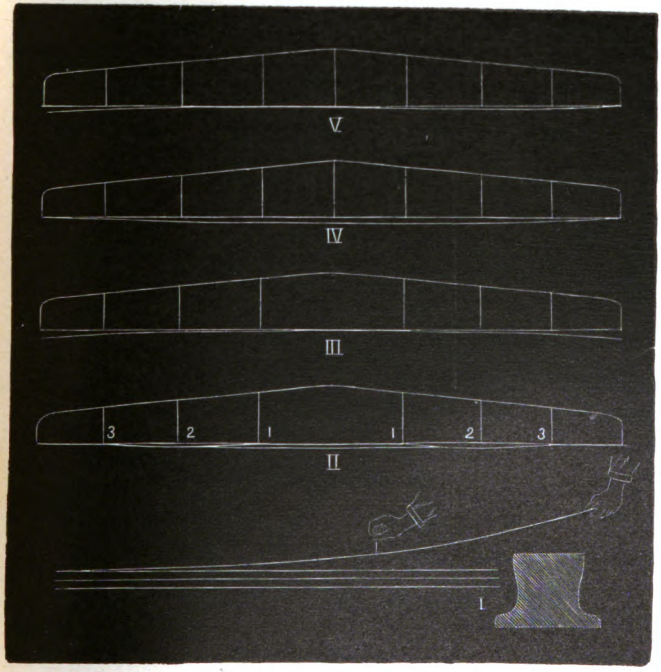


FIG. 9

Fig. No. 9 on this page shows the long straight-edge applied to the saw and how the saws will appear when in different conditions.

No. I of this Fig. represents the saw resting upon one edge and held by hand raised clear from the anvil. The heft of the saw will cause it to spring as is shown. The straight-edge should be applied to it as represented across the middle and at right angles to the position in which it rests. This is the way to examine and ascertain the condition in which it is in. The straight-edge should reach clear across the saw in order to fully show its condition.

No. II shows the straight-edge extending across the saw and divided into four equal parts from the center, each space is numbered for reference hereafter. The curved line on the under side shows the saw as it will appear when opened right for a rim speed of 10,000 feet per minute. The saw should not drop away from straight-edge inside of line 1. This represents $\frac{1}{4}$ the size of the saw and should be left as stiff as it can be made. The saw should not be expanded inside of this line.

No. III represents a saw that is very stiff between lines 1 and 3, and this is the way the saw will appear when tested as shown at the bottom of the cut. Such a saw will make very snaky or winding lumber.

No. IV represents a saw that is too open between lines 1 and 3 and what is called a dished saw. It should be opened on the rim outside of line 3.

No. V represents a twisted saw, frequently found, but not so often as the others.

All of these defects are found by examining with the long straight-edge. This is what it is used for.

It is very seldom, if ever, that a saw gets bent while in ordinary use and when a twist or buckle appears, it is usually caused by uneven tension, the tight places draw and hold the saw out of shape. You should first take the tension gauge and round faced hammer and even up the tension and that will usually straighten the saw, but in case it does not, you will find instructions for straightening in the following pages.

HOW TO HAMMER A STIFF SAW.

When the saw appears stiff all the way around as shown on No. III, page 73, it should be laid out on both sides as shown in Fig. 10, page 77, then take the round faced hammer and strike one true, firm blow as indicated by dots on lines, then turn the saw over and treat

the other side in the same manner. Then examine the saw with tension gauge all the way around and plainly mark any places found tight and use the hammer on both sides until they conform to the tension gauge.

HOW TO HAMMER A SAW THAT IS TOO OPEN.

The saw should be laid out on both sides as shown in Fig. No. 11, page 78, then use the round faced hammer carefully as indicated by dotted lines. Work on both sides and use the tension gauge often to see when the defect is removed. In case you do too much work outside of line 3, it will then be necessary to open the saw between lines 1 and 3, as instructed above.

STRAIGHTENING CIRCULAR SAWS.

While straightening a saw, always use a pad on the anvil. This pad can be made from wide belting free from rivets or uneven spots, leather or rubber; old leather is preferable.

Cut it in shape of the top of the anvil with a narrow strip left on each side to turn down, then make an iron band to fit loosely around the anvil and turn the narrow strips of the

pad down the sides and drop the band over them. This will hold the pad in place while in use and it can be quickly removed when it is found necessary, to expand the steel, which

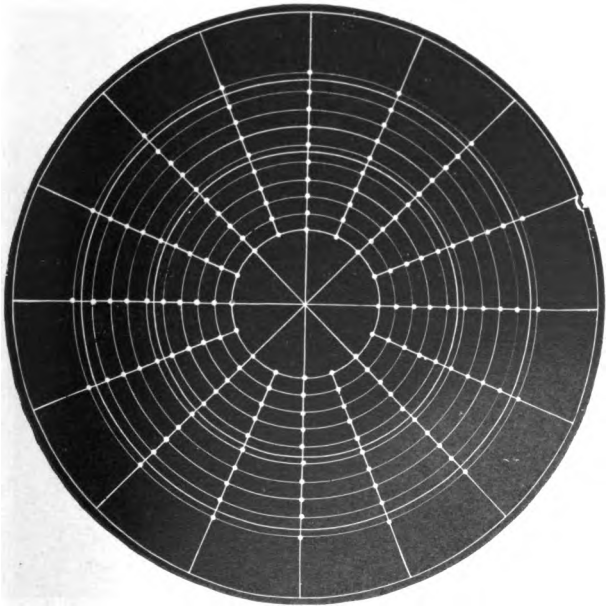


FIG. 10

should always be done on the bare anvil with the round faced hammer. While straightening, strike light blows and use the straight-edge often for if too much work is done it will

drive the steel through and a lump will appear on the opposite side.

Fig. No. 8, page 70, represents a saw that is dished or sprung. Close to the center as will

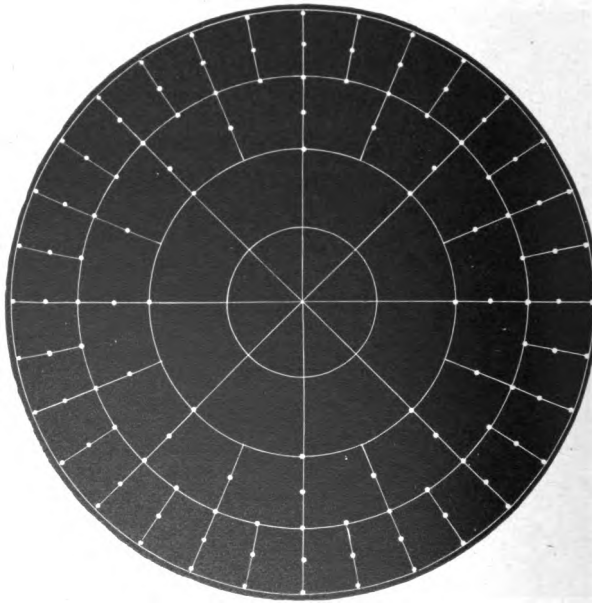


FIG. 11

appear when tested with the long straightedge this saw may be open sufficiently when it is straightened to do this without opening or expanding the center. Place the pad as be-

fore mentioned on the anvil and apply blows on the crowning side as indicated by dotted lines in cut.

One must use judgment as to the number and heft of blows to be struck. If the saw is only slightly sprung, three or four moderate blows may be sufficient to straighten it, but if it should be badly sprung, it will require more and heavier blows. Always work carefully, and use the straight-edge often to make sure you are not doing too much.

A TWISTED SAW.

Fig. No. 12, page 80, shows a saw in this condition and how to lay it out for hammering. A saw that is twisted will show concaved part way across and convexed the rest of the way when the straight-edge is applied as shown in No. V, Fig. No. 9, page 73. The hammer should be used on the crowning sides, the dots show where to hit it on one side and the crosses represent the same number of blows struck on the opposite side.

Saws in this condition may have originated from two causes. First, from being cramped in some manner and sprung. Second, it will become this way if it is too open on the edge

and in the center and too tight between lines 1 and 3. This will cause it to appear winding and one should use the tension gauge first in all cases and make sure that tension is right

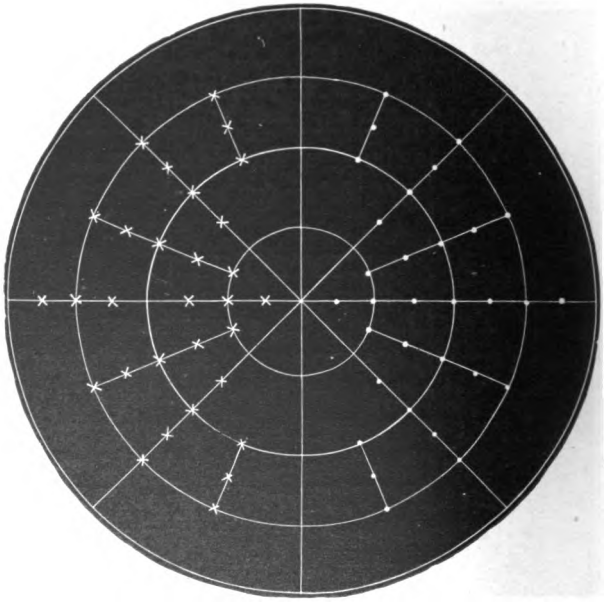


FIG. 12

before you attempt to straighten, for if the saw is held crooked by too much or uneven tension, you will not be able to straighten it until the tension is even.

A BURNT SAW.

Fig. No.13, this page, illustrates a burnt saw with different size spots and showing the different methods to pursue with them. They

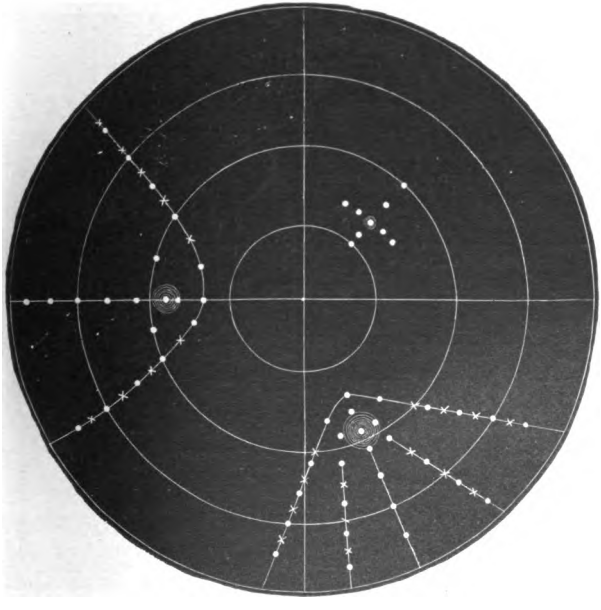


FIG. 13

generally occur upon the saw as represented, frequently they will be all of the same size. A saw will not become burnt when it is all right, saws generally get too stiff or the teeth

are dressed in bad shape and they become cramped in the cut to such an extent that the friction of the timber rubbing against the saw heats it red hot and leaves a discolored spot. A saw which has been burnt in this manner is very apt to need a general rehammering, but in case it does not, place the pad on anvil and hammer on the high places until the saw is level, then examine the tension; if you find it is too open, let out part of the tension as indicated by the dotted lines in Fig. 13.

HOW TO HAMMER SMALL CIRCULAR SAWS.

The above instructions for hammering will apply to small saws as well as the larger ones except on saws which are under 30 inches in diameter and run without a guide and they should be hammered as stiff as possible. Be careful that the rim on small saws does not become loose, but it should not be much tighter than the rest of the blade. Saws which are run with a guide will stand to be more open than saws run without a guide, and will do better work.

Cut off saws should be hammered exactly the same as rip saws.

HOW TO DRESS CIRCULAR SAW TEETH.

No saw should be dressed any other way but right; that is, both sides alike and accurately round and in balance. It is said by some that they cannot dress saws uniform because they do not run uniform. Every saw will run the same if in the same condition; the reason they are not is simply because the filer neglects or does not understand how to test them or how to remedy the defects when found. What is right for one saw, applies with equal force to another. The teeth should all be shaped alike and each tooth should come in contact with the timber at the same angle. A saw will not vary from a straight line without a cause and any man who understands a saw will examine and see where the defects are. All saws should be dressed to run straight ahead and then if they do not run straight, it will be found that they are not properly hammered or the arbor is not in line with the feed. Find where the defect is and remedy it there and you will then be rid of it. When a man understands testing the saw and use of the hammers a few minutes work will put the saws to rights.

SHAPE OF TEETH.

The shape of the teeth is of the utmost importance to the successful running of a saw. It is well known among first class mechanics that when a cutting tool is brought in contact with the surface to be removed at a certain angle the chip is removed with less power and this tool must be ground so that both sides are together at the right angle to produce an easy cutting point. This rule applies with equal force to wood as well as iron. There is a fixed law which cannot well be evaded and the nearer one keeps to it, the better and more favorable success he will have in any branch of labor.

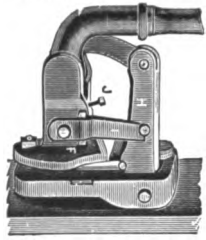
All rip saws should carry a full swage, be dressed square across with the face of tooth, cut under at an angle of from 30 to 45 degrees and the back as high as possible and clear the timber. The tooth should also have sufficient depth to form a chamber which will easily carry the dust for any feed required and this chamber should be round at the base.

SWAGE THE POINT OF TEETH.

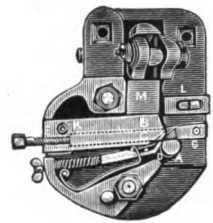
It is necessary to swage the point of teeth and for this purpose it is best to use some good swage which will spread the teeth even

and the widest at the extreme point; to do this, the machine will have to be nicely adjusted and the lower die catch the tooth at the proper place. If the dies work too close the point they spread the steel nice, but the tooth is left in very much the same condition that an upset would leave it, and will require heavy dressing to bring it to a slim easy cutting point; then again, if the dies should catch the tooth too far below the point, they will spread the steel wider below than they do at the point and will crack or split the points. To adjust a swage nicely to different forms of teeth and for doing different kinds of work, it will be necessary to have two adjustments for the dies so that the die can be adjusted independent of the anvil. All swages should be made in such a way that each die can be set independent of all other working parts of the machine.

Kinney Improved **Swage for Circular and Gang Saws.**



CUT No. 13
Exterior View.



CUT No. 14
Interior View.

This is the strongest and most powerful machine made for swaging saws. It is easily adjusted to different shapes of teeth and gives satisfaction wherever used. The interior view shows the adjustment and working parts.

SHAPING THE POINTS OF CIRCULAR SAW TEETH.

After a saw has been swaged it is necessary to side dress or shape the points of all teeth so they will be of an even gauge and full on the face or cutting side. The tooth should taper from the point down and from the face back. It would be difficult to side dress a tooth in this shape with a file, but we have a machine for pressing the points of teeth to an exact gauge and the proper shape for straight easy cutting, and we would advise the use of this machine for side dressing full

swaged teeth. It is much quicker and more accurate than a file and leaves the teeth in a shape that would be next to impossible to accomplish with a file.

After shaping, go round the saw with a side gauge and tooth straightener and straighten any teeth that may have been bent or sprung to one side. The saw will then be ready to grind.

HOW TO DRESS RIP SAWS WITH SPRING SET.

Whenever a spring set is used, great care should be taken to spring the tooth close to the point and both sides alike and see that the corners are kept full and sharp. To do this, it is best to hang the saw on a mandrel in a horizontal position and in such a manner that it can be freely revolved in a true circle, then have an anvil or piece of steel with the edge beveled and place this under the points of teeth when it will give the proper amount of set, then revolve the saw on mandrel and strike the point of every other tooth with a hammer as it passes over the beveled portion of the anvil, then turn the saw over and strike the point of each tooth that stands between

those struck from the opposite side; if the work is properly done it will bend the teeth very close the point and give a true even set on both sides. When points become worn, it is well to upset them a little in order to insure a full corner. We make regular saw sets for doing this work.

Always grind the tooth square on both sides.

HOW TO SHARPEN CIRCULAR SAWS.

After a saw has been swaged and shaped, the teeth should be ground from face and back to a sharp edge and for this purpose it is best to use a good automatic emery wheel grinding machine. They keep the saw accurately round and in balance and it is not necessary to joint the teeth before or after sharpening. If you have not got an automatic grinder, the work can be done on a hand machine, but it is difficult to do it as well and the saws will require frequent and careful jointing to keep them round and in balance.

GANG SAWS AND THEIR CARE.

We have found as the best way to hang the saw, and one that will apply to any gate, and also that will permit the saw to strike the cut

in such a way as to cause the gate to strike easy without pounding or lifting, as either will cause the saw to run bad. There is a point in the revolution of the crank where the crank-pin should be when the saw takes hold of the timber, or if the saw strikes the cut before the crank arrives at a certain point it will cause the shaft to lift, and the floor timber to spring, jar or pound. It is well understood by every one that runs a gang that there must not be any lost motion in any of the movements, but some have been troubled in keeping the gang from pounding; and many times this is a great source of annoyance and breakdown, causing heavy expense with much unnecessary wear on machinery.

TO HANG GANG SAWS.

There are a great variety of gangs with much difference in the movement of the gates.

In hanging gang saws they should be hung so the saw will come in contact with the timber at a certain point of the stroke. It makes no difference what kind of movement the gate has, the saw should take hold of the timber at the right point to make a smooth running

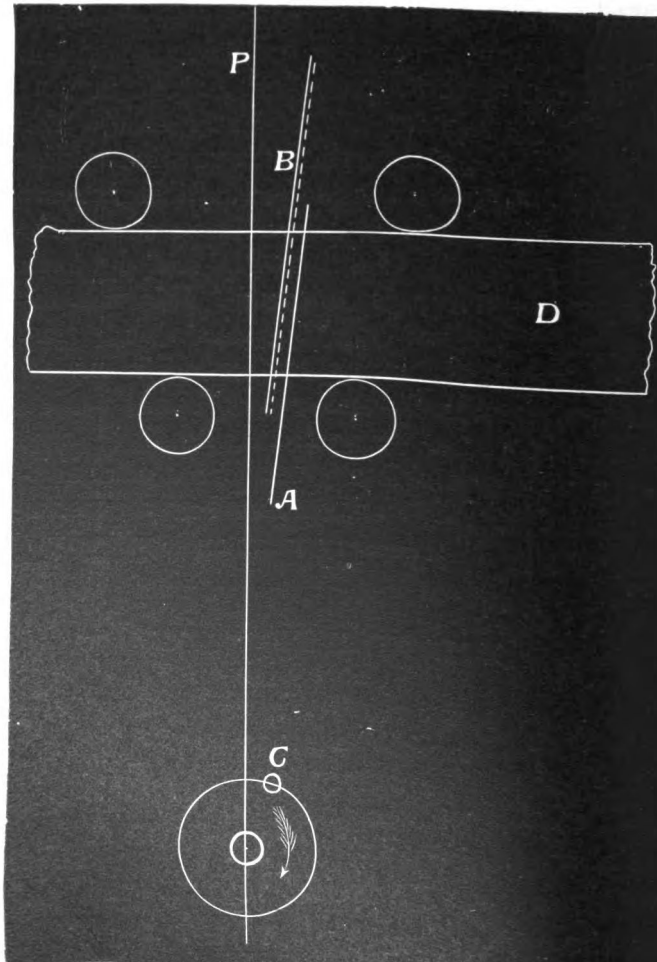


FIG. 14

gate; some oscillating ones bring the saw in contact with the timber in a way that makes the gate strike lighter and better.

Fig. No. 14, page 90, is illustrative of the plainest and simplest rule to hang gang saws, one that will apply to any gang, and show the exact point where the crank should be when the saw comes in contact with the timber. Some oscillating gates move the bottom of the saw forward first, making an under cut, and then throws forward on top and back on the bottom, making what is known as the whip-saw movement; such movement makes the easiest cutting gate, although many get the movement changed and have no rule or guide to go by, illustrating how they can get it to rights again, and we have seen men to have worked a whole season trying to get the gate right and to have failed in the end; this rule applies to any kind of a gate, and when understood can be applied without much labor and will enable almost any one to hang the saw so that it will work the best. C represents crank, showing the exact point where it should be when the saw comes in contact with the timber. By measuring from line P one-sixteenth of the revolution of crank, forward of the line as shown in the cut. P is a plumb

line from the center of crank-shaft. A is the line of the cut of saw, when the crank is on the lower center. B is the line of the saw when the crank is upon the upper center. D is a plank the same width as the stroke of the gate. This plank should rest on the edge upon the feed-rolls, and the press-rolls allowed to rest upon it to keep it upright as shown in Fig. No. 14.

Straight slide-gates require some overhang to the saw, and some oscillating gates; some gates are thrown forward by throwing the bottom of the upper slide forward. This throws the saw forward until the crank reaches the bottom of the stroke, and then as soon as the saw commences to raise, it throws the saw back clear of the cut; such gates the saw does not require so much overhang, and some not any, as the slides give the saw the same forward movement, yet that does not make any difference as to testing by this rule the movement of saw.

This is simply the best and quickest way, and the only one we have ever found that will successfully work on all kinds of gates, and show the exact motion of the saw. In practicing by this rule, the first thing necessary will be to make up your mind the amount of

feed you wish to carry; for example, we will take ½ inch. To hang the saws suitable for that in straight-slide gates, the saw should have an overhang of one-half the feed, and 1-16 of the half inch would be 1-32 or 9-32 of an inch in the length of the stroke for ½ inch feed; this is for friction or continuous feed, but for the hitch or rachet feed, the overhang should be 1-5 more than the whole feed.

For example, for ½ inch feed, the overhang should be 17-32, that is, 1-16 more than the feed in the length of the stroke; always go by the length of stroke and not by length of saw; you can go by twice the length of stroke and twice the above overhang, or 1-16 more than the whole of the feed. In case your gate is an oscillating one, hang the saw as usual and test the hanging by this rule.

The way to test the hanging of saws is to remove all of them, and then hang one saw in the gate with the teeth to the back, giving the saw the usual overhang or in accordance with the amount of feed you wish to carry, by hanging the saw with the back forward, you can mark down the edge better than if it were hung right side to the cut.

After the saw is hung, take a plank the width of the stroke and dress it smooth so that

a fine mark would show, and set it as shown by D, close to the saw. The press-rolls to keep it upright and also to allow the feed rolls to move it the same as the cant is. After this is set turn the crank-shaft slowly until the crank is on the lower center, mark down the edge of the saw shown by line A, then turn the shaft until the crank stands as shown by C. This should be done accurate, setting the crank 1-16 of the revolution.

If the saw is hung right, the edge of the saw and the line marked on the plank shown by A will just come together; but should they pass each other, there is not oscillation or overhang enough to the saw. In the latter case more feed can be carried and the gate will strike better, and where the feed is not enough for the overhang will cause the gate to pound on the down stroke, or a chucking motion, causing the cant to be driven back and prevent from feeding up to the regular feed. The saw under such a state of affairs is more likely to clog by reason of the saw striking the cut after the crank has passed the designated point.

After the crank has passed this point, the gate begins to descend with greater rapidity, and when the saw strikes the cut on the de-

scent will cause the saw to buckle and spring, causing the cant to give back.

If the saw has not enough overhang or oscillation the saw will take hold of the cut before it begins to descend and while standing; this causes a lifting or pounding motion to the gate. Less feed will relieve this difficulty, but to carry the desired feed it will be best to overhang the saw or give more oscillation, and until lines A and B come together as shown by dotted line when the crank is at the desired point; this is where the gate begins to descend, and at this point, if the saw takes hold of the timber it will not take near the power to drive the gate, as you get the heft of the gate to drive the saw through the cut. Whenever the saw takes hold before reaching this point, they are nearly stationary, and in coming in contact with the timber will cause them to remain standing and will require more power to start the gate, and this lifts on the shaft, which under this treatment there is more strain on the machinery, but not so much danger of the saw buckling, as when there is too much overhang. When saws are hung as described at least 25 per cent more feed can be carried as a general thing. This cut simply shows the outline of the rule giv-

ing such points as are necessary to make it plain to millmen, and giving a positive rule for hanging saws which is applicable to any kind of a movement, where the slides are set on an incline, the slide can be changed until the line A and B come together, and the crank is at the specified point.

These points are very essential for good running saws. Many get the saw hung very near right, but cannot tell how they do it, yet by repeatedly trying they do it very well.

The next thing to be understood is the shape of the teeth, how to set and keep them so.

TO MAKE THE BEST SHAPED TEETH IN GANG SAWS.

This is a consideration with gang saws that but very little attention is paid to. The tooth should not be too long nor too short, neither too heavy nor too light, but should have the desired hook and the right shape back to make an easy cutting tooth, and must be of some one shape preferable to another.

It is the same with gangs as with circular, a gang tooth should come in contact with the timber at the same angle or degree. We have

made inquiries of a great many men how to get the right shaped tooth, but the general reply is about so and so is the best and cannot give any particular rule or way to follow.

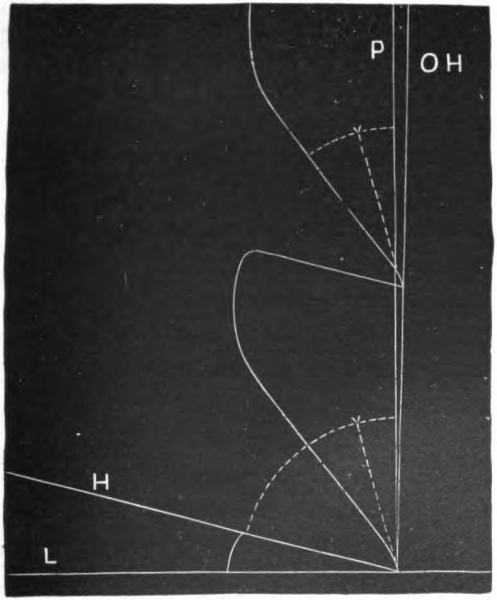


FIG. 15

The foregoing Fig. No. 15 will give a fixed and positive rule how to make the best shaped tooth, one that will give the right angle or hook to the bottom, regardless the way the saw is hung in the gate. This cut shows the

tooth full size that are generally being run with the saws used. The following description will enable any one to lay out this tooth: First hang the saw with the right overhang or oscillation for it to get the right hook, drop the gate half way down; this is the point where the oscillation is the most; place a parallel straight-edge on the feed rollers, shown by line L, allowing the teeth to rest on the top, measure from the point of tooth back the same distance as is the stroke of the gate (for example) say 20 inches from point of tooth; at this place fasten a post or stick at right angle with line L, measure one-fourth the diameter of the stroke, as 20 is the whole, 5 is one-fourth, place another straight-edge at the point of the tooth, and the other end 5 inches above the line L, make a mark in the tooth from the point back the depth of the tooth; this gives a quarter hook to diameter of the stroke the same as the hook of circular saw, the depth of the tooth is best not more than one-half the distance apart on a one and half inch tooth, $\frac{3}{4}$ is plenty deep enough to carry all the feed usually carried.

To get the right shape to the back, measure from line L at the base of the tooth up to line H, then place a straight-edge against the front

of the teeth shown by line O H, strike a circular line from the base of the tooth as shown by the dotted line, then measure from the face of the teeth back the same distance on the circular dotted line, as it is from L to H at the bottom of tooth, then strike a line from the point of tooth as shown by straight dotted lines; this causes the point of tooth to come in contact with the timber both sides alike, also gives the right shaped tooth on the point, just above the same as what is made when the tooth is pointed down with the hammer, and prevents the saw from drawing into the timber and buckling, the tooth should be cut out as shown to make necessary room for sawdust.

This makes the best shaped gang saw tooth that we have ever been able to find; after you have these lines on one tooth make a pattern and lay out each tooth by it; that will be right for that gate.

With the old way of filing, it is impossible for any one to maintain them, but if an automatic saw sharpener is used and set to one tooth it will make every tooth like it and keep them just right. The tooth does not get shorter or loose; the hook, which alone is of vast importance to the saw gangs or others,

and where there is a successful way for saws to be what is desired, that should unhesitatingly be adopted.

TO HAMMER GANG SAWS.

But few men understand how to hammer or roll the gang saw, and many more do not know as they ever require hammering or rolling more than to straighten them. It is just as essential that gang saws should be tensioned in order to give them the right strain and to fit them to make better lumber. When a set of saws are tensioned right they will stand up to 35 per cent more feed on the average. In order to do this work one should have the right kind of tools, which consist of a roller or stretcher and a hammer with a round face. We prefer this kind of hammer rather than have two or more as some do; one wants a good anvil, smooth and hard faced, to enable you to draw the saw at the desired place. The next is a true straight-edge 8 or 10 inches in length. Fig. No. 16, page 101, shows three gang saws and how to lay them out preparatory to hammering them.

No. 1 represents the straight-edge applied to the saw and as you will find the majority of gang saws this shows the edge of the saw

dropped away from it, as it is applied across the saw when one end is held in the left hand and the other resting upon a bench, and the center sprung down by its own weight. Ap-

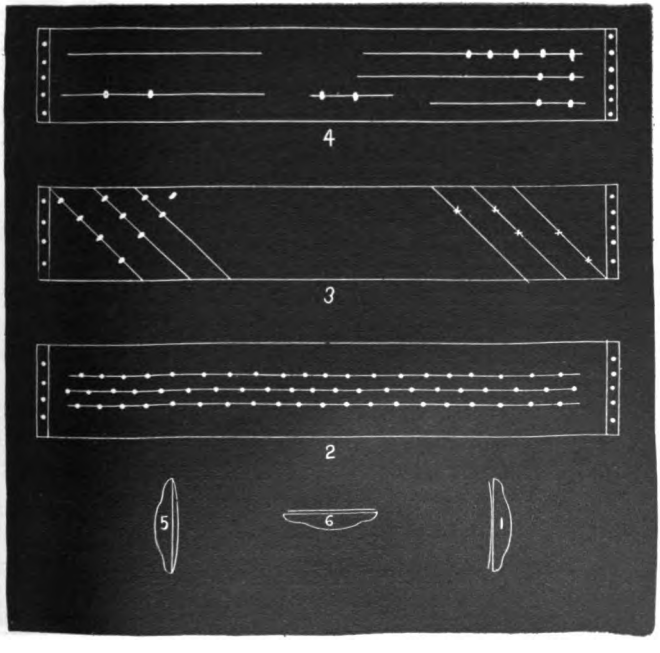


FIG. 16

ply the straight-edge to the other side and it will appear the same way. No. 2 represents this saw upon the side laid out ready for ham-

mering. It is better to lay out the work by the right system in order to help new beginners.

This saw is very tight in the center and open or long on the edges; such saws cannot be properly strained, the edges being the longest, when the saw is hung in the gate and the key drove, the strain is through the center of the plate; this leaves the edge loose; such saws will dodge and make snaky lumber, and as long as the center of the saw is the tightest the edge will buckle. Such saws will not carry half the feed that one will when just the reverse like No. 5. No. 2 has 3 lines of blows through the center. It is best at first to go along the center line, then the two outside ones, then turn the saw and do the same thing on the other side. If that does not open enough go over the saw as at first, but not so many blows.

We recommend a roller for doing this work as it does not crystallize the steel near so much as hammering. The saw should drop away from the straight-edge all that it will by its own weight when resting upon both ends, and when held up edgewise that it will appear straight as shown by No. 6. If the saw is opened too much it will somewhat as-

sume the form of a letter S; in such case the edges should be opened, and this will allow the saw to straighten out; always use the hammer on the full side, saws in this condition when strained in the gate are tighter on the edges, and will keep the saw firm and not allow it to dodge. This is quite a job where a whole gang of saws are taken, but they can be done a few at a time. No. 3 represents a twisted saw and also how to apply the straight-edge, shown by the lines running across the saw; if the straight-edge is applied the other way it would appear straight. You will use the long-faced hammer shown by the oval dots on one end and crosses on the other; they show where the trouble is, and the same rule as is applicable to circular saws.

In regard to getting out the twist, the lines show the way the straight-edge is to be applied, and the long way of the hammer should cross these at right angles with the marks, the end where the crosses are wants to be turned over and the blows applied on the opposite side, invariably striking the saw on the full-spots or rounding side. Always use the long-faced hammer on twisted saws, and many times it would be best to use a pad on the anvil when straightening, if the saw is

open enough. As is often the case that saws will get bent or twisted by a piece of bark or sliver getting wedged in between the saws; many use a wooden block for this purpose in place of an anvil, which is very good. No. 4 shows a saw bent but not twisted; by applying the tests as shown the dots represent the full spots; the blows of the hammer will take such spots out and straighten the saw.

In hammering gang saws they should appear straight, no lumps or open spots on them; use the short straight-edge in straightening them, and not trust to the eye. Gang saws should be made as limber as they can be made, that will admit of straining them better in the gate. When the saw is opened in the center as we have instructed, and strained in the gate, both the front and back edges will be of like strain; this will prevent the saw from buckling, and such will stand from 25 to 50 per cent more feed and make better lumber.

It is no trouble to make 16 gauge saws stand $\frac{5}{8}$ to $\frac{3}{4}$ inch feed, providing they are opened in the center and have the right shaped tooth and side dressed to give the right angle to the side. No saw should be gummed with either press or retoother; it will

take three times as long to get the saw straightened and opened as it should be after gumming, than it takes to gum it out.

If an Automatic Saw Sharpener is used it prevents the stretching of the edge of saw and keeps the right shaped tooth, after it is once fitted and got in shape the machine keeps them so.

The instructions we have given in regard to gang saws will enable all to improve the running of the gang. We have never found a man that understood all that we have given in regard to gangs, and some use one thing and some another, but we have made it a point to gather together all the best tests experimentally and otherwise, and present them in this form so that who may desire can have the benefit of them.

TO HAMMER SHINGLE SAWS.

Shingle saws are uniformly made so heavy in the center that they do not generally get out of place there, but sometimes the saw gets sprung outside of the collar; they get sprung down by a spalt getting caught in the carriage; in such a case remove the saw from the collars and hang it upon the arbor, try the

straight edge upon the straight side and find where it is too full, mark the places and use the hammer on the straight side until the saw is nearly level or true; shingle saws can be slightly dished from the edge of the collar out; this can be done in the same way as giving lead to the saw with the hammer.

If the saw is thick and driven less than 1,100 revolutions per minute, it will not be necessary to open the saw much or may be slightly from the second to third line, the most that can be done is to keep it straight and true, and saws that cut both sides as they do in double block machines should be hammered dishing nearly 1-32 of an inch; some have them more than that, but we do not think it best to throw the edge up too much; the nearer straight this saw is the better it will run.

The more the edge is thrown up out of line with the center of the saw, the more the centrifugal force will draw it down, as most shingle saws run horizontal and the motion to throw it down with the gravitation, together with the block passing over it, all have a tendency to cause the saw to incline down out of the cut. The saw being thin on the edge and much smaller in diameter, the rim will not

expand enough to affect the running of it. Then the saw is furnished with a heavy collar, which prevents it from buckling. It is very essential to keep the saw true and straight; sometimes when one side may become lopped down, it can be raised with the hammer without taking off the collars and with less work than to true it up with paper, and if the collar has not sprung it can be brought back to its original place. These saws should be sharpened on an Automatic Sharpener, which will keep them true and balanced at all times.

CROSS-CUT SAWS AND THEIR CARE.

In saw mills these saws are often neglected, as it does not matter as long as they cut, but if proper care is taken the saws will last longer and cut easier, which means less power. They should be properly tensioned. (See page 65, instructions of hammering large circular saw, which will apply to these saws as well. Also page 82, how to hammer small circular saws.) They should be well balanced, which will take care of itself if sharpened on an automatic sharpener, which will also keep them gummed, and will leave

plenty of room for sawdust. Saws sharpened on such machine are less liable to break or kink. They can be sharpened on Hand Sharpeners or Gummers, but more care should be used so as to keep them true, so that all of the teeth are cutting when in use. The shape of teeth is largely governed by the kind of wood to be cut, but in all cases the throat or bottom of teeth should be round, which prevents cracking. To set cross-cut saws, see page 87, how to dress saws with spring set.

SPEED OF SAWS.

There should be a standard speed for saws. The speed necessary to accomplish the best work should be the one adopted. Although there are matters of opinion to be settled which vary from 7 to 15 thousand circular feet per minute. Now there must be a point somewhere between these numbers that the saws will do the best.

Saws can be run at any speed between the above number mentioned, but there is a medium point, one that the saw will do the best work. Our experience has led us to adopt ten thousand circular feet per minute as the medium speed for all saws, no matter what the

size of the saw is, what is right for one is right for another, or as near that as may be; 500 to 1,000 feet variation is hardly perceptible, although we would much rather have just the right speed, but it will vary slightly as the saw wears smaller.

Were there such a rule adopted, it would result in the end of a great saving to millmen, and also enable saw makers to furnish such saws as would give better satisfaction, as they could have a fixed rule to hammer them to.

If you get below 10,000 feet per minute, then you cannot carry the feed. To those that cannot maintain the motion with the power they have, it would pay far better to increase the power; then you can make a success of saw milling.

There is a limit to saws as to speed, and the capacity of cutting lumber. It is natural for men to experiment, and is all right so to do, for that is the way best results are reached. But to those that do not wish to spend time and money in so doing and are willing to accept our experience, they will save the time to themselves we have spent to inform ourselves on the subject.

To hammer saws for a higher rate of speed, the saw will require to be open so much that it will dish either way, that should never be done; in such a case where the saw becomes warm in the center and cause the saw to lop whichever way the strain is. Where the speed is 10,000 feet the saw can be hammered so it can vary 100 revolutions per minute, and then make good lumber.

With so many opinions about the speed, it is hard to furnish saws which will be the best adapted for the work. There are a number f things that can be done that will enable most any one to run their saws to the right speed. If you lack power, reduce the feed until the speed is maintained; many may think by that they cannot cut so much lumber, but the majority of mills will cut more.

Some mills are lacking in power and motion by not running the engine fast enough, if the engine were run faster as a rule that will accomplish the desired result. If that cannot be done, then there is another remedy which will give better results, that is reducing the number of teeth in the saw, or reduce the cutting surface of the teeth. In ordering a saw that will give the best results, go through your yard and measure the cuts on

fifty boards that have been cut on different days, then average the cut, and whatever it amounts to, multiply by 16; that will give the right number of teeth.

NUMBER OF TEETH FOR SAWS.

We ascertain that by the amount of feed we wish to carry; we allow one tooth to every 1-16 of an inch feed, regardless the size. We have found the most successful running saws to be those that carry the above feed, although many saws are crowded far beyond that limit, but if there were more teeth added so that each tooth will remove but 1-16 of an inch of timber, the saw would do better work, and could be crowded to double that in light cuts through soft wood; but in hard wood we would allow 20 teeth to remove one inch of timber.

There are but few saws that cut hard wood that carry more than three inch feed, the average feed in hard wood is less than two inches. The above number of teeth can be used either spring set or full swage; when swaged will add double the number of corners to the saw, and such saws can be crowded harder and will make smoother work. We

have given the number of teeth for 6 and 7 gauge saws. If you wish to run thinner saws, it would be preferable to add more teeth, as the thinner the saw the lighter chip should be taken. We will below give the number of teeth to each gauge of saws, necessary to remove five inches of timber to each revolution of the saw, to wit:

6 gauge saw should have 80 teeth.
7 gauge saw should have 86 teeth.
8 gauge saw should have 94 teeth.
9 gauge saw should have 110 teeth.
10 gauge saw should have 126 teeth.

The above is for circular saws. It matters not about the size of the saw, so long as you wish to carry five inch feed to the revolution.

The above number of teeth will carry five inch feed if the tooth is kept in good shape.

The number of teeth has much to do with the running of the saw. There is such a thing as having too many teeth, as also not enough, and to get at the right number, it requires study and practice to arrive at the best results, both in feed and thin saws, as to governing the number of teeth a saw should have.

The following extracts taken from *The Wood-Worker* of Indianapolis, Ind., are opinions of practical filers and sawyers:

ROLLING VS. HAMMERING.

By J. S. Philippi.

The title, "Rolls vs. Hammer," will be familiar to readers of *The Wood-Worker* of some years ago. Why it should ever have been invented I am sure I don't know. I cannot conceive how the modern and progressive filer can possibly allow any litigation or controversy to arise between the relative merits or use of these different tools. They certainly both are necessary, and together are efficient in the economy of band saw work, and the filer who in the present day will undertake to do all his work, under all conditions, without all those tools, must certainly do so through some kind of prejudice.

I was initiated into this business without the use of the rolls, and, as Mr. Gebott has said, "Not every filing room in those days was equipped with them, and that much good work was done without them." I have fitted saws successfully until they were worn out by that good old method, but I hailed with delight the more general introduction of the rolls, as they are a wonderful labor-saving device.

There is an occasional filer to this day that will not use the rolls, though he has them at hand. Then you find those, more numerous, who have no use at all for the live anvil. I have gone to work at two different places where no anvil had ever been in-

stalled in the filing room. I know one filer who worked three years in a place and never had one. I must say that the samples of work I found in the two places mentioned above were not what I would consider first-class by any means.

Personally, if I were obliged to choose between an outfit consisting of rolls and a wooden slab and a wooden mallet, or of an outfit consisting only of an anvil, iron slab and good set of hammers, I would most unhesitatingly choose the latter. The wooden mallet has its place in a wood-worker's kit, but I would think it a very unsatisfactory tool in "corrective measures" on a band saw. On the other hand, being instinctively humane, I would no more think of striking a blow on a saw that would cut in than I would think of striking such a blow on our favorite domestic animals. I know one filer who has no use at all for the rolls and says they are no good at all. That settles the matter with him, without giving any good reason for his dislike of them. One writer more than a year ago said that users of the hammer left small fast spots in the saw. It may be true of such as strike very heavy and very few blows, but the proper use of the hammer is to strike more and lighter blows, and it has been my observation that those who use the hammer more or less have their saws more even in tension than those using the rolls exclusively.

We are all made upon different lines, and I think it is a good thing for our progress that we do not all think alike and work alike, unless such thinking

and working were more nearly on a level with our masters in the mechanical arts. Ours, however, is a little art, in which we cannot interest such masters as an Edison or a Marconi. We have to make our way alone. The success of the band mill depends on our genius. We have, therefore, very much to gain by an impartial and unselfish interchange of ideas and actual methods employed in our work. I think the time has well passed for the entertaining of the petty little jealousies, etc., that obtained among filers of twelve or fifteen years ago. No one of us will ever be able to file all the saws in the country or have a monopoly of this trade. A statistician claims that with the present rate of cutting, the timber in the state of Oregon, for instance, will last about 138 years. Then evidently there will yet be filers needed after we have done our little stunt.

When I was working in other mechanical lines it used to be a great pleasure to me to have the opportunity to go among others of the craft and see how they did things. In these rounds I would often see things done that were new to me, and that I would willingly adopt. I have experienced the same pleasure in going among filers and seeing them at their work. I have seen many whose methods I could not possibly adopt, but they seemed to be adapted to their wants, so why should I find fault?

It has so far not been my privilege to run across a filer who uses the same methods in the fitting of a saw as I do, though there may be such; and then, again, no one else might ever want to use these same

methods. My next-door "neighbor," for one, has expressed himself plainly in telling me it is "too slow, and too much work about it." In regard to both these faults I may some time have more to say. One of the most successful filers I have ever known personally claimed it was two days' work to fit a new saw for the mill, and one day's work to fit one whose tension has merely run down by use and needs an overhauling. I noticed that about one-fourth of that time he would put in at rolling, and the rest on the slab at leveling. He claimed to be a fast worker, but I do not regard that as quick work.

To roll a saw successfully it must first be level. A stretcher, as all filers know, with the two rolls ground alike, and a level saw passed through them on a level, should not dish a saw. Dish is simply a condition in which the metal on one side of a plate is longer or wider than on the other side. Hammer one side of a saw with a dog-faced hammer and it expands most on the opposite side, hence is dished. Hammer it with a crosspean and it expands more nearly equal on both sides. Roll it on a level with two rolls ground mechanically alike, and the two sides should expand alike. But a filer of considerable experience told me just a short time since that he had never found nor used a roll but what did dish more or less, and I am compelled to say that has been my unfortunate experience.

All finely-spun theories to the contrary, I wish to ask how many filer readers of this can level up a saw

first (if it needs it), roll it, put it on the mill without again leveling it, and guarantee it to not lead in or out in the cut? Or, in how many cases out of ten can he do so? For these reasons, and for reasons to my mind economical, etc., I have for years adopted and worked on an entirely different method than that which obtains among filers of my acquaintance and knowledge. For instance, when I take a saw on the bench after its usual run, and which has met with no accident in that run, I use the rolls somewhat as I would the hammer—i. e., roll it in short sections where it needs it and as it needs it, being careful to rather underdo than overdo this part of the process. Now, instead of taking the saw on the slab to level, I take it on the live anvil, and with the dog-faced steel hammer, in spite of all the unnameable bugs attendant, I go over it three light rounds to tension gage in this way, finishing up, of course, on outside. After these three light rounds my saw will show same tension on both sides, which simply means that the metal is same length on each side, therefore cannot be dished nor have any dished spots. And forty-seven in forty-eight times it will run in a straight line.

This is the part of my process that my "neighbor" calls too slow. Well, how slow is it, and how much work is there to it? I notice he spends more time at the slab than I do at the live anvil. Besides, I notice that his saws, after his process, do not show the same tension on each side, nor the even tension that mine

do. Again, I was "made with bones in my back," as the old farmer said, and I had as soon work an hour and a half or more at the anvil than one hour at the slab, because at the former I can work in a natural standing position, while at the latter I cannot. And, again, while his tension is only a general average throughout the saw, so is his leveling only the same, and I see him have to take his saws on that slab every now and then and give them a turn in the other direction.

I have given the above as an installment for an "actual practice" department, and shall be pleased to discuss different methods with the readers of our favorite journal.

CROWN VS. STRAIGHT-BACK BAND SAWS.

By Lawrence J. Nittle.

For many months past different writers have been discussing, in the columns of this journal, whether the band saw put up with a straight back or with the back crowning is the proper thing to insure the best all-round results in cutting.

In my experience, and, therefore, in my opinion, the band saw put up with its back slightly crowning, say 1/16-inch in 6 or 7 feet, all else being equal, will always be found to give entirely better results from a straight-sawing, hard-feeding and good-lumber point of view than the straight-back saw will, but if any filer, having little regard for the welfare of his

employer, wishes to make a record for long life in saws, then I think it probable the straight practice would be the proper thing for him.

Of course, in setting down my views upon this matter of "Crowned vs. Straight-back Band Saws," I do not expect I will succeed in converting many straight-back men to my views upon this question, but nevertheless I am going to argue my case out in as common-sense and logical a way as I am capable of, and if I do not succeed in demonstrating to the satisfaction of the said straight-back men that the crown-back saw, properly fitted and handled, makes the most efficient saw for general saw mill purposes—which in modern practice means nothing more or less than quantity and quality of output—then I will be content to think, although absolutely sure that my premises are right, for much experiment on my part has shown it to be so, that my arguments in favor of the crowned-back, although well founded, are not set forth in such a manner, through lack of tact or ability, as to carry warrantable conviction with them.

The best practice in band saw fitting is that which fits the saw to produce the greatest quantity of first-quality work with the least expense to the proprietor of the mill. This I think will be admitted by the advocates of both the crowned and straight-back practice. Quantity, quality and the expense of producing the best in each of these are, then, the three principal factors in ideal practice. All these have a very di-

rect and important bearing upon profits, and as profits in saw milling, like in all other branches of industry, are the main objective, it is only the band saw practice which produces a maximum of profit to the proprietors of a mill that can rightly be called ideal practice. Therefore, when we have decided upon the style of band saw fitting, as regards crowned and straight backs, that will do the straightest cutting upon the fastest feed, with the least expenditure of cash, we have ideal saw fitting.

At the outset, in trying to get to the bottom of this matter, we will refer briefly to a point that has perhaps some slight bearing upon the matter of expense —that is, the lasting qualities of saws put up under the crowned and straight-back ideas. I do not think there is any doubt but that if two bands of steel without teeth, say 10 inches wide, and exactly alike in quality in every way, were taken to a bench and rolled out, one with a straight back and the other with the back crowning 1/16-inch in every 6 feet, and then put upon band wheels, at exactly similar tension, to run on until one or the other of them cracked and gave way, the straight-back saw in most cases would come out victorious. This much, I think, I may concede to the straight-back advocates, but further I do not care to go. Put these two blades, toothed, to work cutting lumber from clear logs at any easy rate of feed that would not tax either of them to stand up to, and there is a possibility that the straight-back blade might still more than hold its own, as regards

life, with the crown back; but put both blades into hard, cross-grained and knotty lumber, such, for instance, as our northern white spruce, and run them at a killing feed, and I do not think it would take long to convince the hardest headed straight-back advocate that ever handled a dogface hammer in a filing room that, neither life of blade nor in quality and quantity of output, is the straight-back saw in any way equal to the saw with back that is crowned. If the crown-back saw will do better work than the straight-back saw on equal feed, or as good work on a faster feed, as I have many times proven it will, then the crowning saw is the ideal saw where quantity and quality of output combined are desired, and it would still be the ideal saw even if it were really a fact that, in practice, the straight-back saw will outlast the crowning-back tool, for, after all, the gain in lasting qualities of one blade over the other would be small recompense indeed for the loss in quantity of output and in quality of lumber produced by the other blade.

But some one might here wish to ask how it is that I claim, after practically admitting that the straight-back saw will last longest when running idle upon a pair of band wheels, that it will not last longer, nor as long, as a crown-back saw when both are taxed by heavy feed in actual practice. To this I would say that in running idle upon a pair of band wheels the straight-back saw, because of the fact that both edges of it are the same length, has the strain put upon it by the tensioning device upon the machine equally

distributed between the two edges, whereas when the crown-back saw is put upon the same wheels and strained, owing to the front or tooth edge being shorter than the back edge, naturally a greater portion of the strain is carried by the shorter front edge, even if the tilting device upon the upper wheel of the machine is used to counterbalance this to some extent, for we must not forget that there is still the lower wheel, upon which there is no tilting device arranged, to reckon with. This, of course, necessitates, in the case of the crowned-back saw, the front edge carrying a much greater (at least 25 per cent. more, I should say) strain than the front edge of the straight-back saw would carry, and therefore, undeniably, cracks would be more liable to develop on the front edge of the crowned saw than on the front edge of the other.

Now, all the above relates, of course, to saws running idle upon the wheels, and were there not counterbalancing effects in actual practice we would be compelled to admit that there is more argument in favor of the straight saw than there really is. It seems quite reasonable that the front edge of one saw, having greater strain upon it than the front edge of another saw, would not last as long as the one with the lesser strain, but it is my purpose to show, as stated above, that there are counterbalancing effects in actual practice which entirely wipe out the advantages, in this line, of the straight-back saw over the crown.

All filers admit that a crowned front (not back) upon a band saw, no matter what tilting, crossline or other devices are upon the machine, is an "impossible" thing in practice. Such a saw could never be made to cut properly except, perhaps, at an extraordinarily slow feed, and even at that it would do better work upon a roll of cheese than upon a soft white pine log. We will presume that the crowning upon the front edge of such a saw is equal to ¼-inch in 6 feet. Now reduce this crowning to 1-16-inch in the same length, and I do not think anybody will deny me when I say this saw could be made to do very much better work, and upon a faster feed, than formerly, when it had the ¼-inch of crown upon it. But still it would be far from satisfactory because the back edge, being shorter than the front, would carry the greater part of the strain, and the front edge, being loose, would be liable to lead from side to side, snakewise, in a cut, thus producing lumber altogether unsalable in the grade to which its quality as timber would otherwise warrant. And right here is where the counterbalancing effect in wearing or lasting qualities of saws put up in the crown-backed style comes in. The straight back, as before admitted, has an advantage in this when running idle, with no feeding strain upon it, but put a very heavy feed upon the straight-back saw and it is far more liable to dodge in and cut, and the jerking strain put upon it when in the act of doing this dodging, to my mind, quite counterbalances the cracking ten-

dencies in the crowned-back saw, with the fiddle-string cutting edge that will not dodge. It is the front edge of the saw that does the cutting, therefore it is the front edge of the saw that needs the most strain, and the only way to give it extra strain over that of the back edge is to shorten it, or otherwise lengthen out the back, thus putting a crown upon the back. Some one has remarked here, "What about the double-cutting band?" I would say, there is no double-cutting band, which is, necessarily, put up straight, that will stand the feed of a single-cutting band or the same width of solid plate, simply because it is impossible, in a way, to put the same strain upon both cutting edges of it as it is possible to put upon the one cutting edge of the single-cutting band.

But, to continue the evolution of the saw with the ¼-inch crowning front that will not cut straight, as mentioned above. We have seen that a saw with only 1-16-inch of crowning front will necessarily cut better than a saw with extremely loose front edge caused by the ¼-inch crown. Now reduce this front edge crowning still further until you have a saw absolutely straight, and upon which, when on the wheels, the tension upon the back and front edges is absolutely equal. Here you have the ideal saw of the straight-back advocate, and there is no denying that under certain conditions you have a fairly efficient saw, especially if the balance of your fitting operations have been carried out in a workmanlike manner. We have seen that the ¼-inch crown upon the cutting

edge is not good practice. We have seen that the reducing of this ¼-inch crown to 1-16-inch improves the cutting capabilities of the saw, both in feed and in lining. We have also further seen that the reducing of this 1-16-inch of crowning in 6 feet still further increases the efficiency of the saw. Each step in this evolution, it must be admitted, has increased the ability of the saw to do straight cutting and to stand fast feeding. This being so, I want to know why this evolution should stop as soon as an absolutely straight-edge condition is reached, as our straight-back advocates claim. Why not, I ask, carry the evolution still further and gain still more in straight-cutting and fast-feeding qualities by actually hollowing the front edge of this saw, that was formerly crowning, and thus transfer the extra strain that was formerly upon the hollow back, where it was perfectly useless, to the now hollow front edge? Everybody knows that tension upon the front edge of a band saw is the one thing, outside of the proper fitting of the teeth, that makes it walk up a straight line; and if a little tension, or strain, on a front edge will make a saw walk up a line where it formerly would snake, then why, by all the rules of logic and common sense, should not greater strain make the saw follow a line still more tenaciously, and why, if a straight-back saw will stand a faster feed than a crowned-face saw, should not a crowned-back saw stand a greater feed than a straight-back saw? To me this seems very reasonable, and had not much

experiment proved these premises to be right, common reasoning would still have led me to believe it is a reasonable conclusion to come to.

About a year ago I was called into a box factory where the main part of the work was getting out glass box shooks. These were cut from white pine cull boards of the grade that is usually known as dead culls. These cull boards are usually well loaded with pine pitch, and are, as a rule, fairly wide, coming, as they mostly do, from rotten butt logs. In this factory they had an old saw mill filer fitting their 6-inch 20 gauge band resaw blades, and, to tell the truth, he was doing work that was even more rotten than the lumber. And I wish to remark here that if there is one class of lumber in the world that is harder to resaw straight than another, it is dead pine culls.

This old filer was a very staid straight-back advocate, and any man who would venture to advocate the crown back in his presence was very liable to be called a fool for his pains. But, in any event, after a three months' trial with his straight backs upon this dead cull resawing, he was at last compelled to admit that whatever the cause he was beaten. When his saws were sharp—that is, for an hour or so after they were taken from the grinder and put upon the machine—they did fair work, but once they began to get dull a change became absolutely necessary. As stated, this straight-back man finally admitted himself beaten, and I was then called upon to look

for the reason of it. I had formerly done the work in this filing room, and, as the proprietors knew, had never had much trouble in doing all the straight resawing that was required, and my saws would last their half day quite handily.

Investigation showed me that the old man ran his saws with straight backs, but no amount of research would show me other faults in his fitting. In fact, he did what I call very pretty work, both with his hammer and filing apparatus. I asked the old fellow if he had ever tried crowning his backs, and my answer was a very broad grin and a very decided "What rot!" "Rot or no rot," replied I, "as anyone about here will tell you, I always made these saws go when I held your position, and so far as I can see, the only difference between your saws and mine is that I ran with a crowning back and you run with the straight." "Well, young man," said he, in return, "I have been filing for a good many years now, and have always found the straight-back saw good enough for me, but if you can show me that the crowning back will overcome the difficulty here, I am willing to see you try it."

This invitation was eagerly seized upon, and together we went at one of his blades, rolling it out until the back had the prescribed 1-16-inch crowning in 5 or 6 feet. When this was done I let the old man do his own adjusting of tension and fitting of teeth. This finished, we took the blade to the machine, and, putting it on, adjusted the tile (no crossline) to the

new conditions. When everything was set, we started the machine, and I am happy to say that for five solid hours that saw walked through those dead culls at a rate of feed that simply astonished my old friend, and about the only thing he could say all the rest of that day was, "Gosh! a fellow is never too old to learn."

This was not the first dyed-in-the-wool straight-back band saw man I had converted to the crowned idea, and I hope, in the interests of ideal practice, that he will not be the last, for, as said in the beginning of this article, much experiment has proven to me that the crown back is the proper thing.

PRACTICAL HINTS ON TEMPERING, GRINDING, ETC.

By W. F. K.

To the file-pushers that read the Wood-Worker I want to say that this is my first attempt to make any comments on the exchange of ideas carried on in the columns of this journal. In my opinion there are some brilliant ideas advanced, some laughable, and others ridiculous. Take braze tempering, for instance. I want to ask a few questions and answer them myself; make some comparisons and give my ideas, and give the fellows that don't agree with me an opportunity to get back at me in the November number.

It seems to me the braze tempering business has simmered down to a simple mechanical proposition that could be understood by everybody that is familiar with the changes that take place in steel by reducing it from a high to a low temperature quickly. There is no magic or sleight-of-hand performance about it; the same principles are involved in tempering, whether it be a band saw braze or coldchisel. However, we are unable to heat the braze hot enough, without destroying it, to get the desired temper, so let us do the best we can under the circumstances and cool it at the hottest possible point after the solder has set.

I have no trouble with bent brazes, and am sure, if you will do the work as I suggest, bent brazes will be a thing of the past with you. My process requires neither extra time, money, labor nor skill, and is very simple. After clamping the hot irons on the saw to make the braze, remove them just before the red changes to black, and cool as quickly as possible with wet towels or "waste." It is impossible to get the braze too hard by this process. This is very easy to try, as you do not go to any extra work, and I am sure if the work is done properly and quickly, you will get good results.

There is one thing certain, if you harden a braze you must reduce it from a high to a low temperature quickly. The only reason it is difficult to get the temper high enough in a braze is, you cannot cool it until you release the clamp, and you cannot release

the clamp until the solder has set, consequently when the cooling process commences your braze is not quite hot enough to get that portion of the saw as hard as the balance of the blade. But it will be hard enough to prevent it from bending.

I have seen some discussion regarding the Seek attachment for automatic grinders. I consider it absolutely worthless for the simple reason that perfect grinding can be done with any automatic grinder, providing it is in proper shape and the saw is properly prepared for the grinding. The attachment may be a good thing if the saw is in such condition that it takes varying power to push it through the grinder clamp, but if the saw is clean and oiled with coaloil where it goes through the clamp, it will feed absolutely perfect and there will be no need of the attachment. We have two Covel grinders in this filing room and the saws are treated as above. I cannot remember the time that we have had any blue teeth from the imperfect travel of the saw. Of course, the device referred to does not hurt the machine, neither does it do any good if the saw is properly cleaned and oiled, which task can be accomplished in about one minute by taking a little "waste" saturated in kerosene oil and going round the saw, inside and out, where the clamp comes, after it has been placed on the grinder. Those having trouble with grinding will be astonished at the difference in the working of the machine by this simple process.

SET OR SWAGE, WHICH?

In sawing molding stock the stock is generally perfectly dry by outdoor seasoning or made so by kiln-drying, and the little spread of tooth necessary for ripping it is hardly perceptible. And if the outer point of the tooth is sharp and clean, as it should be, the smaller the amount of the spread of the tooth is the better. Very much depends on the guide in this matter, and, generally, if more attention were paid to this part there would be less need of spreading the teeth like a pair of buck's horns either with set or swage. I will allow it takes more genius, if we can apply that term to it, to swage than to set, but when the knowledge is once acquired there is the end of it. The operation is as simple as pricking one's self with a pin, and the habit of filing square, which is one of the necessary accompaniments, is easily caught onto.

Filing square across in all ripping work should be an established habit. A saw filer should acquire this habit from the start. The common way of turning a saw around when filing is entirely obviated when using a set, and the filer is able to keep in one relative position to the saw and give every tooth the same form. Much of the trouble in sawing with a bench saw or any other kind comes from the irregular form of the teeth, for it is just as necessary to have every tooth the same form as it is to have them all the same length in order to do nice work. The swage

very naturally keeps one up to this point, for if a saw is well and properly swaged one would hardly care to file away from the form made by it.

Another thing in its favor is that both sides of the tooth are cut at the same time, hence both sides of the tooth give support, not only to the tooth itself, but to the whole plate, which prevents that rattling sound so commonly heard in bench sawing. I know the swage would keep Tom and Dick and Harry away from the filer's bench, which would no doubt make a day of mourning in many mills where everybody from the teamster up makes free use of both saws and file "ad lib.," but this would only be a real blessing in disguise to the owners.

To me the advantage of the swage tooth is so plainly evident that it would seem that seeing one at work would be the only argument necessary to prove the statement. The old saying that "seeing is believing" does not always convince those who were educated under the old regime, when a thousand feet per day was considered a fair day's work for the old reciprocating saw mill. I often wonder if there are not some people so set in their own grass-grown opinion that they would not know a good thing if they saw it.—*Lumber.*

HOW TO USE EMERY WHEELS.

Too great a variety of work should not be expected from one grade of wheel. If the amount of grinding will warrant it, several grades can be profitably em-

ployed, each carefully selected for its particular purpose. Wheels should be kept perfectly true and in balance. In order that they may not become in the least out of true an emery wheel dresser should be used to dress up the wheels a little each day, or as often as they require it.

In mounting emery wheels never crowd them upon the arbor. Use flanges at least one-third the diameter of the wheel. Flanges should always be concaved and fitted with rubber washers between flange and wheel. Have wheels slip easily on the arbor and screw flanges only tight enough to prevent wheels from slipping. Stands on which wheels are mounted should be heavy and strong, and solidly bolted to a firm foundation. Keep machine well oiled, so that arbor will not become heated, otherwise there is danger of wheels breaking from expansion of arbor.

Users of wheels are particularly cautioned not to run wheels on shaky machines, or on machines in which the arbors have become loose in the boxes from wear. See that rests are properly adjusted in relation to the wheel, otherwise accidents may occur owing to work being drawn between the wheel and the rest. Never run wheels at a higher speed than the maker recommends. Don't try to grind malleable iron with a wheel that was made for brass, as no one wheel can be made which will be just right for grinding all kinds of metals.

To obtain the best results, emery and corundum wheels should be run at a surface speed of 5,500 feet per minute. Wheels if run too fast will heat the work and glaze, and if run too slowly will wear away rapidly and do but little work. The same speed should be maintained as the wheel wears down, and the speed of the spindle should be increased correspondingly as the diameter of the wheel is decreased. Where there is a sufficient amount of grinding to warrant the use of more than one machine, this can be accomplished by transferring from the first or larger grinder to smaller ones as the wheels wear down, otherwise by means of cone pulleys.

DOUBLE CUTTING BAND SAWS.

N. E. HUFF.

Commence with the band mill and line bottom wheel with track, no lead either way; then put top wheel in line with bottom, no crossline or overhang. The face of wheels should have a very slight and true crown from edge to edge. This done, commence with saws and see that they are straight, no long or short back. Commence in the extreme center of blade and open them just deep enough to fit nicely over the crown of wheels and have them hug the wheel the hardest, or the most strain, at the extreme edges of the face with a gradual decrease in strain from each edge towards the center. This done, put saw on top of bench and level on inside of same that part of saw

which is lying on leveling slab by going over it with straight edge reaching across full width of saw, and level it down so that the most light shows under straight edge in center of blade (where tension is deepest) with a gradual decrease towards the edges, until you come to the tires, which should not show any light under the straight edge. After which again go over this section with straight edge, first on one edge of saw, then on the other, by holding straight edge say 2-3 the way across the blade, looking for, and hammering down any small lumps which may appear on the particular edge and which you were unable to locate when holding the straight edge across the entire width of saw. When holding the straight edge two-thirds the way across the blade, the light should not show as deep under it as when holding it across entire width of blade, because when holding it across entire width of blade, both ends of straight edge are resting on the two tires or thickest part of saw, and when holding only two-thirds the way across the blade only one end of straight edge is resting on the tension or thin part of saw. In like manner go over the entire inside of saw, after which put it down on the bench "on the bottom" and go over the outside of saw in the same manner as with the inside, always bearing in mind how much light showed under the straight edge when you were leveling the inside and trying to equalize same when leveling the outside of saw, being especially careful to have no light show under straight edge on either side of saw from where

the tension terminates at the edges. If you are not satisfied that you have the saw sufficiently level to insure its doing good work after going over each side, repeat the operation until you are satisfied.

The most important part of bench work is to have my saws level. For this work I have a cast iron leveling slab about 3x12 inches by 6 feet. This slab has a perfectly straight and level face, both lengthwise and crosswise, and forms a part of my bench. I use a 14-inch straight edge to level by, which I am very particular to see is straight at all times.

When do I put the tension in a saw, or go over it to equalize the tension? Answer: after leveling my saw on the inside the entire length and while leveling the outside, I level a section on the outside and then try the tension gauge on that section. If any tight places appear, I roll them out, after which I again try my straight edge to that particular part, to see if in putting in the tension my roller has punched through or pulled up that particular part of saw rolled on. If pulled up, I again level and try tension; if punched through, I mark saw with chalk on the other side at that place, so I may know the cause of lump when I come to level on the other side again, which I would certainly have to do.

I have had men tell me it was not the fault of the roller that the saw was punched through or pulled up. To others of the same opinion I would advise them to try a saw on a roller which has a top roller with a more crowning face than the bottom, and see if the

saw is not pushed through, or with the rollers vice versa, and also notice if the saw is not pulled up. I have my saw lying perfectly flat on the bench (the bench is in perfect line with the top face of bottom roller) when rolling in tension.

In sharpening, a single cut sharpener equipped R and L hand is preferable to use of two separate sharpeners for by using the same machine for sharpening each edge of saw, you are certain to obtain the same shape and hook in the teeth on each edge, consequently both edges, if properly gone over on the bench, ought to stand the same amount of feed. Moreover, in such case your swage will swage alike the teeth on both edges of saw. Always go over a newly swaged saw with a set gauge, making sure that the teeth are all perfectly straight.

LONG AND SHORT FACED TWISTS.

A. J. BURTON.

There are two kinds of twists that are liable, through accident, to get into a band saw, known as long and short faced. The hand of the saw has nothing to do with the twist, as there may be long or cross-faced twist get in R. or L. H. saws. If you have a saw that is running and doing very good work, but when taken off mill and placed on floor will not stand up, but has an inclination to fall over in the shape of a figure "8," this may be a long or cross-faced twist, as the case may be, and half the filers in

the country don't know which it is. Now, it is impossible for a doctor to cure a patient unless he knows the disease. So it is with filers. Unless you know the kind of twist your saw has, you cannot take it out. But if you will remember that whichever way the top of the saw falls, shows the way the twist runs, you will not make a mistake. For example, lay your saw on the floor. Then stand at the middle of the saw with the teeth from you, and if the left hand end of the saw falls toward you and the right hand end falls from you, it is a long faced twist. But if the left hand end falls from you and the right hand end towards you, it is a cross-faced twist. (Every time.) Such twists usually run all the way around the saw and if the saw is flat with good even back and tension, it will not hurt the cutting capacity of the saw, only that the saw will rather lie down than stand up when on floor or bench. But if you will follow the instructions here laid down, you can take out such a twist without a blow with the hammer, for if the top part of the left hand end falls toward you, pick it up and get on the bottom part with your feet close to the left hand end. With your hands press hard over the opposite way. Let some one hold the other end up for you and continue to roll the saw, moving your feet say two inches at a time with an even pressure with your hands till you go all round the saw. If you use care to do it right you will be surprised to see the saw stand up again as straight as a new saw without the use of a hammer. The reverse of the above for a

cross-faced twist will remove that also. Now don't forget that when you stand with the back edge of the saw to you, that if the left hand end falls to you, it is a long-faced twist, and if from you, a cross-faced twist. Sketch No. 1 shows cross-faced twist, and for long-faced twist, saw will fall at the top toward the arrow or in opposite direction from that shown in cut. Now, to remove this long-faced twist, pick up saw with hands and place feet on bottom, having some one hold up the other end. Then roll saw, marking with chalk to show you when you get round. Repeat this and with a little brains and practice, you will soon take out a long or cross-faced twist and make your saw stand up nearly as good as ever. It will be well for you to put it on the bench to see if you have put in any short bends or lumps. If so, you must remove them with the cross-faced hammer, taking care always to have the long way of the hammer blows running in the direction of the lump or twist and always bear in mind that you cannot hammer the high corner of a twist down, but you can raise the low corner up. Every one knows that a hammer blow must be put directly on a lump or ridge to remove it.

USE OF SAW STRETCHER FOR REMOVAL OF TWISTS.

We have received from D. D. Williams, a band filer of many years' experience, directions and designs for the construction of the necessary irons for the re-

moval of twists in log band saws. Mr. Williams' experiments have been made with a Bolton No. 5 Stretcher, but the principle upon which he works and the special irons required can be applied to our No. 6 and 7 stretchers and in fact with some changes to any of our different types of stretchers. The irons are designed to fasten on the guide slide of stretcher, or in case of a machine where such attachment is not possible, can be fastened to the woodwork of bench. The action of irons on saw when this is fed through machine by pressure of rolls, forces the plate into a bend or twist opposite to that existing and by suitable variations and a little practice it is claimed that a short twist extending only 3 or 4 inches or one extending the entire length of saw, such as tends to produce a figure "8," may be removed. To any who may require this device and the directions for using it, we are authorized to supply the rig at a price of $7.50. Once equipped always equipped.

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